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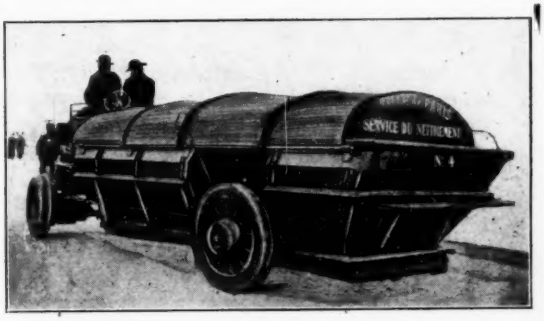

A FRENCH AUTOMOBILE TRUCK *for hauling garbage.*

VOL. XLVI. JANUARY, 1914. No. 1.

"There is a time in every man's education when he arrives at the conviction that envy is ignorance; that imitation is suicide; that he must take himself for better for worse as his portion; that, though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given him to till."—Emerson.

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PAVING METHODS IN BALTIMORE

By Harry D. Williar, Jr., Asso. M. Am. Soc. C. E.,
Assistant Engineer, Baltimore Paving Commission.

Mr. Williar has been actively engaged in the construction of roads and pavements first with the State Roads Commission of Maryland and later with the Paving Commission of Baltimore, and shows in this paper the methods which have been developed by the latter commission in transforming Baltimore from the city of cobblestone streets to a city of modern pavements. The experience of other cities has been supplemented by local experiments and the results upon the latest of the large cities to modernize its paving are very noticeable.

THE City of Baltimore has, up to the past few years, been generally recognized as "The City of Cobblestone Streets," and this unique distinction has not been undeserved. Since the first cobblestone was laid in 1781, Baltimore has steadily increased its mileage of this class of paving until, on January 1, 1912, out of a possible 590 miles of street, 408 were paved with cobbles.

In order to better meet traffic demands and hasten the elimination of cobblestones, the city has been divided into two paving sections, each division being under the supervision of a separate commission. The paving of that portion of the city lying between the old and new city limits, or the outskirts, is being done by the Annex Improvement Commission, while the paving of the city proper is under the supervision of the Paving Commission of Baltimore.

¶ CAREFUL ATTENTION *to the selection of materials bears a most important relationship to the success of any pavement and each factor governing quality and use of material should be carefully considered.*

The writer's purpose is to discuss conclusions reached by actual practice, and ideas obtained thru careful study from a Baltimore viewpoint, the conclusions being applicable, in a general way, to any other city.

The most important consideration in selecting the materials to be used for certain streets are:

1. The location of the street, as to whether it is in a business or residential district.
2. The character of traffic to which the street is to be subjected, as to whether it is light, heavy, "standing" or thru traffic.
3. The grade of the street.
4. The width of the street.
5. The existence or non-existence of street railway tracks.

¶ THE QUALITIES OF PAVEMENTS *on which depends the choice of material are briefly stated.*

There are few cities where one class of material can be laid on a street for its entire length. Due to the heavy grades and general topography of the city, this feature is particularly noticeable in Baltimore, and it is often spoken of as the city of variegated paving.

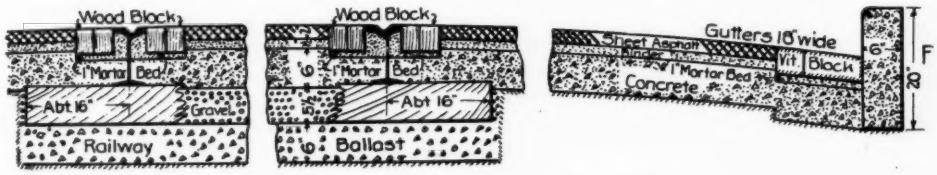
The following general qualities may be accepted as absolutely essential to good paving:

1. It should be impervious.
2. It should afford a good foothold for horses.
3. It should be hard and durable, so as to resist wear and disintegration.
4. It should be adapted to the grade.
5. It should suit traffic conditions.
6. It should offer the minimum resistance to traction.
7. It should be as near noiseless as possible.
8. It should yield neither dust nor mud.
9. It should be easily cleaned.
10. It should be economical.

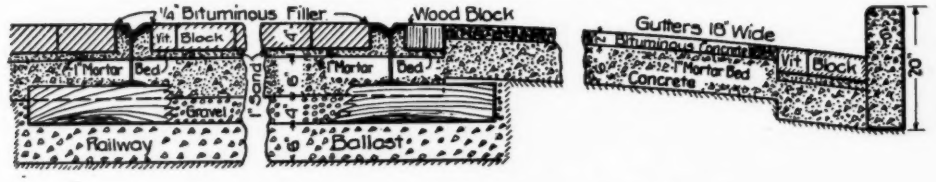
Vitrified Block comes in between Granite Block and Sheet Asphalt, and up to 7 per cent. grade makes an excellent and sanitary paving for the semi-residential thorofares of average traffic. On grades between 5 per cent. and 7 per cent., "Hillside Block" can be used to great advantage. With the uphill edge of the blocks beveled, a better foothold for horses is given.

Wood Block Paving, when the blocks are properly treated, is recognized as an exceptionally durable surfacing, but should not be used on over 2 per cent.

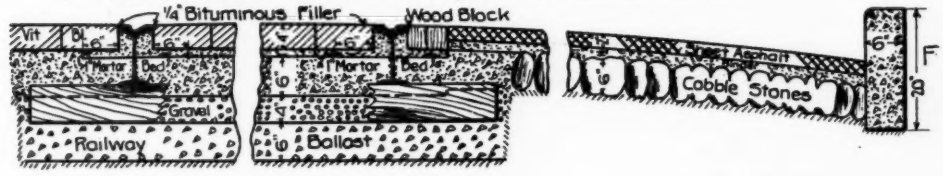
Standard Section for Sheet Asphalt.



Standard Section for Bituminous Concrete.



Standard Section for Sheet Asphalt on Cobble Stone.



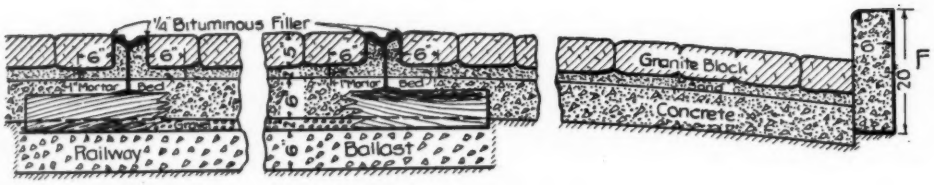
From these general essentials, the following deductions are logically made:

Granite Block should be used on all streets of steep grades, and in business districts where the traffic is either heavy or standing.

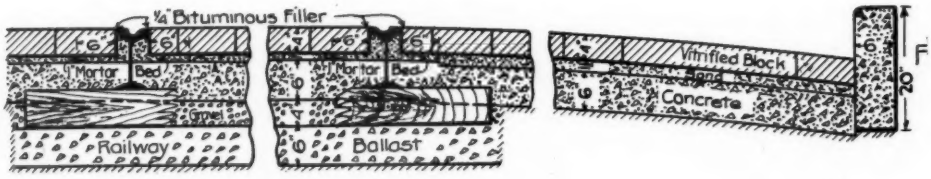
Sheet Asphalt is the standard surfacing for residential sections. It may also be used to advantage in the business districts where there is thru, but not exceptionally heavy, traffic. On grades up to 5 per cent. it gives excellent results; on steeper grades it becomes slippery and unsafe.

Bituminous Concrete is a paving which is slowly, but surely, working its way to the front. It is entirely a light traffic surfacing, and should be used almost regardless of grades in the residential districts. On suburban streets, where sufficient width may be obtained to avoid concentration of traffic, along and in city parks, thru towns and villages, bituminous concrete makes an admirable pavement.

Standard Section for Granite Blocks



Standard Section for Vitrified Blocks.



It will be found that most failures in paving are on streets where there are railway tracks, and, to be more specific, these failures are, nine out of every ten, immediately adjacent to, and running parallel with, the rails.

The material used adjacent to the rails may be any of the following: wood block, vitrified block or granite block. In no case should sheet asphalt or any bituminous paving come in direct contact with the rails. If granite block or vitrified block be selected for a street with car tracks, the thorofares may be paved with either of these two materials thruout.

If sheet asphalt or bituminous concrete be used, they should stop at least 6 inches from each rail, and two rows of either wood block or vitrified block be laid as liners. The wood block is preferable as it does not chip off by traffic turning in and out of the track.

Wood block liners may be used to advantage on vitrified block streets for the above reason. In any event, to insure less failure of paving at the rails, the writer advocates the liners adjacent thereto being laid on a 1-inch mortar bed instead of on sand, this bed to extend 6 inches from each rail.

As to the wearing qualities of these standard paving materials, it may be well to note the result of a test made by the city of Baltimore in 1901. The city furnished the concrete foundation and labor, while the competing contractors furnished free their different samples of paving material. The block of street when finished, presented in neat little widths two kinds of sheet asphalt, seven kinds and colors of vitrified block, two kinds of granite block and one sample of wood block. The traffic at this particular place was very heavy, and it was not long before the bed of the street resembled a relief map. It was a sure and conclusive test, and the granite block and wood block, alike, stood it better than any other.

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¶ RESULTS OBSERVED *in Baltimore's test pavement were made use of in designing new pavements as well as the factors governing the life of a pavement which are usually considered.*

Baltimore immediately proceeded to profit by this experiment and laid a large amount of wood block paving, but there is practically no wood block paving being laid in Baltimore now, on account of its tendency to become very slippery in damp and rainy weather. In order to overcome this objection on the wood block streets laid some years ago, a thin coat of Fairfield or Ugite binder with stone chips is being spread at a cost of 14 cents per square yard, and is giving the desired results.

The life of any pavement is entirely dependent upon: (1) construction; (2) maintenance; (3) traffic. The life of pavements, well constructed, maintained and in a section where traffic is uniformly distributed over different streets, may be taken as follows:

Granite block, from 25 to 35 years.

Granite block, from 25 to 35 years.

Sheet asphalt, from 15 to 20 years.

Wood block (treated), from 20 to — years.

Bituminous concrete, from 8 to — years.

Bituminous concrete and creosoted wood block are both comparatively new pavements, but there is every indication that the treated wood block will be a material of great endurance.

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¶ THE COST *often determines the material and design to be used.*

The cost plays a large part in the selection of materials for streets, but it should not be overlooked that expensive pavements are not necessarily the best, nor are those which cost the least the cheapest. The following are average prices for Baltimore city during 1912:

Granite block, 6-inch concrete base and cement filler, $3.21 per square yard.

Granite block, 6-inch concrete base and bituminous filler, $3.32 per square yard.

Vitrified block, 6-inch concrete base and cement filler, $2.14 per square yard.

Wood block, 6-inch concrete base, and bituminous filler, $3.00 per square yard.

Sheet asphalt, 2-inch topping, 1½-inch binder and 6-inch concrete base, $1.71 per square yard.

Bituminous concrete, 2-inch thick, 6-inch concrete base and paint coat, $1.46 per square yard.

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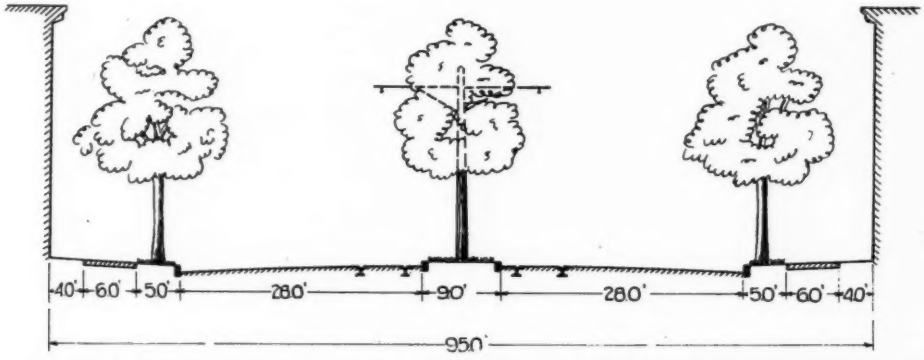
¶ DESIGNING OF BALTIMORE STREETS *is based on a thoro technical study.*

Baltimore today is constructing a great number of miles of improved paving along lines recommended by the Topographical Survey Commission.

There is a great deal of money wasted in paving a street along its original lines, just because they are original. If a 42-foot street, with 66 feet between building lines, can, without reducing its usefulness, be narrowed to a 30-foot street, it is decidedly advantageous. As 13-foot sidewalks are sufficiently wide, the space remaining between the edge of the walks and the new curb of the narrowed street may be used as a parking space. With properly selected shade trees at certain intervals and grass planted in such places, a most pleasing effect is obtained.

On streets lying on the outskirts of the city, along public parks or other municipal property, or on streets where the distance between building lines is exceptional, it is possible to construct a street



A DESIGN *for a cross-section of a street with a double line of street car tracks which alternates trolley poles and trees in the wide space between tracks. Small trees give little trouble, but as they grow they must be trimmed carefully if not rendered unsightly.*

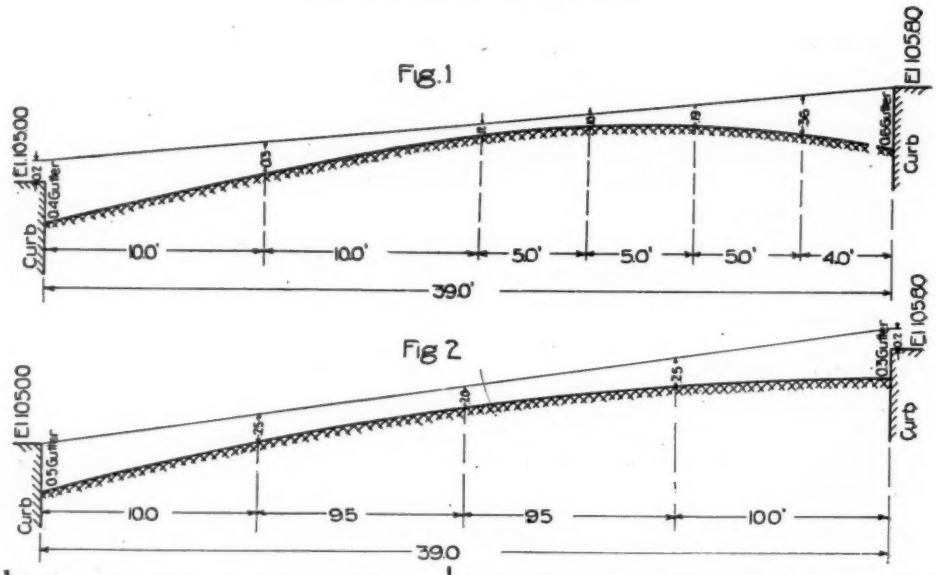


FIG. 1 *shows a cross section of a street on a side hill which requires some gutter area on the upper side. Fig. 2 shows a side-hill street with all the water turned to the lower side. The water must be removed from the street by inlets to sewers or drains at frequent intervals if either design is used.*

of ample width, putting the car tracks off to one side and a planting area between. With proper shade trees, grass and hedge in the planting space the effect of this entire layout is most admirable.

On streets where railway tracks must, of a necessity, be paved in the regular cross-section of the street, the width and location of the thorofare should govern the cross-section to be used. If the greatest width that can be gotten between curbs is from 40 to 50 feet, the section should be a regular parabola with the tracks in the center, but, where possible to get a street from 50 to 70 feet wide in the residential district, the writer recommends some form of parking to be used instead of paving the entire street. For instance, a car track street of 65 feet between curbs may be divided up into two 28-foot driveways with a 9-foot planting space between. A track on either side of this parking area, with trolley poles and trees planted alternately therein, aside from hiding from public view the overhead center pole construction of the railway company, gives the street a very pleasing boulevard effect.

If a street is without car tracks, and has four steady streams of varied traffic, some slow and some fast moving, it is possible, by giving each kind of traffic a section of the street to itself, to avoid accidents and not retard or congest traffic of either class. Should a layout be desired to accommodate such conditions as these, an opportunity is afforded to construct an imposing thorofare. Planting spaces lined with trees along and between the several thorofares, with a line of shade trees at the extreme curbs, will add greatly to the appearance of the boulevard.

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¶ GRADES *can not be greatly changed in a built-up city. Cross-sections are affected by transverse grades.*

In Baltimore, where the thorofares to be improved are mostly in built-up sections of the city, it is impossible to do much changing in the grades of the streets. A cut or a fill where houses are only 12 or 14 feet from the old curb line would result in great damage to property.

The cross-section of all streets should be worked out to conform to a parabola, as a "typical cross-section," to which there are several variations.

On average width streets, when the difference in elevation of the curbs is 6 inches or more (hillside streets), one of

Crowns for Brick, Stone and Wooden Pavements in Feet.

Distance between Curbs	Grade of Street.																		
	Level	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%
20 Feet	25	24	23	20	20	19	18	16	15	14	13	11	10	09	08	06	05			
25 "	32	31	29	27	25	24	22	21	19	18	16	14	13	11	10	08	06	05		
30 "	38	36	34	32	30	29	27	25	23	21	19	17	15	14	12	10	08	06		
35 "	44	42	40	38	35	33	31	29	27	25	22	20	18	16	14	12	09	07		
40 "	50	48	45	43	40	38	35	33	30	28	25	23	20	18	15	13	10	08	05	
45 "	57	54	51	48	45	43	40	37	34	32	29	26	23	20	17	14	11	09	06	
50 "	63	60	57	54	50	47	44	41	38	35	32	29	25	22	19	16	13	10	06	
55 "	69	66	62	59	55	52	48	45	42	39	35	32	28	25	21	18	14	11	07	
60 "	75	72	68	64	60	57	53	49	45	42	38	34	30	27	23	19	15	12	08	
65 "	82	78	74	70	65	61	57	53	49	45	41	37	33	29	25	21	16	12	08	
70 "	88	84	79	75	70	66	62	57	53	49	44	40	35	31	27	23	18	13	09	
75 "	94	90	85	80	75	71	66	61	57	52	47	43	38	34	29	24	19	14	09	
80 "	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	05

Crowns for Asphalt Pavement in Feet.

Grade of Street.								
Level	1%	2%	3%	4%	5%	6%	7%	
30	27	23	20	17	13	10	07	
36	33	29	25	21	17	13	08	
45	40	35	30	25	20	15	10	
53	47	41	35	29	23	18	12	
60	54	47	40	34	27	20	13	
68	60	53	45	38	30	23	15	
75	67	59	50	42	33	25	17	
83	73	64	55	46	37	28	18	
90	80	70	60	50	40	30	20	
98	87	76	65	54	43	33	22	
105	94	82	70	59	47	35	23	
113	100	88	75	63	50	38	25	
120	107	93	80	67	53	40	26	

two sections may be used: (1) Where there is gutter water or "daily flow" to be taken care of on the high side of the street, it becomes necessary to design a section to conform to a compound parabola that will confine the drain water to the gutters. In this case, the crown should be near the quarter point on the high side of the street, with the cross slope falling therefrom to both curbs. (2) If there is no gutter water on the high side of the street to be taken care of, a section of a parabola may be used that will throw all the surface water to the one gutter on the low side.

Sections similar to that of the latter case are ideal in business dictricts, around freight yards and warehouses where the backing in of teams demands the extension of the paving from the curb line on one side to the building line on the other. In such cases, only one gutter is practicable. If local conditions demand the abolition of both curbs, and the paving to extend from building line to building line, then it becomes necessary to design a section that will drain both sides of the street to a gutter in the center. This form of section is not advocated by the writer, as it is bad on horse traffic in freezing weather, but, where it cannot be avoided, an inverted parabolic section should be used.

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¶ CROSS SECTIONS *of pavements should be computed by these formulae or taken from the accompanying table.*

Streets of smooth surfacing require less crown and cross slope than those of rough.. The following formula, for determining the cross-sections of the different kind of paving, is in general use, and is an excellent one:

For sheet asphalt pavements:

$$C = W/600 \ (9 - G)$$

For brick, stone and wood pavements:

$$C = W/1{,}600 \ (20 - G)$$

Wherein,

C is the crown of pavement in feet.

W is the distance between curbs in feet.

G is the number of feet fall per 100 feet of street.

THE REFUSE DESTRUCTOR
at Northampton, England.

The English sanitary engineers have developed the high-temperature refuse destructor to a high state of perfection and this article gives a description of a large plant located in a densely populated district, concerning which there are no complaints of nuisances caused by odors. Alfred Fidler, M. Inst. C. E., Boro Engineer and Surveyor, was in charge of the construction and supplied most of the information presented.

The refuse destructor is situated in Castle street, in a densely populated portion of the town, on a site about 1¼ acres in area and nearly surrounded by dwelling houses, the destructor itself being in close proximity to houses on the western boundary. It was completed and put into operation in August, 1903, and has since been in continuous use.

The plant consists of an 8-cell Heenan & Froude destructor built in two units of four cells. The grates are 4 feet 9 inches by 5 feet with boilers behind and parallel to the destructor, connected by means of combustion chambers with by-passes in the main flue, with a flue beyond to the chimney. The plant is installed with Howden's system of forced draft, and is accommodated in a steel framed structure lined with brick, 102 feet by 50 feet wide, arranged in two floors, the lower floor being the clinkering floor and the upper floor being the charging floor from which the refuse is distributed into the furnaces.

The charging floor is approached by an inclined roadway leading from the main entrance. The forced draft consists of a 78 in. diameter blowing fan fixed on the charging floor from which it takes the supply of air, the fan being driven by an inverted type single cylinder enclosed self-oiling steam engine. The air drawn in by the fan is passed thru an air-heater which is placed in the main flue of the destructor and is forced into the various furnaces at an average pressure of 2½ inches and a temperature of about 300 degrees F.

The steam plant consists of two double-flued steel Lancashire boilers, 30 ft. long and 8 ft. in diameter, suitable for a working pressure of 160 lbs. per sq. in.

Boiler Feed Pumps. There is one Worthington type and one Weir type pump, each capable of pumping 2,000 gallons of water per hour against the working pressure of the boiler.

Economiser. The economiser is Green's and is fixed in the main flue and of the usual type.

Chimney Stack. The chimney is circular and 125 ft. high. It is lined with firebrick to a height of 100 ft. The base of the chimney internally is formed to act as a dust catcher and to give the gases a cyclonic action and to aid precipitation of dust which is held in suspension. Cleaning doors are provided at intervals for removing accumulations from time to time.

The plant is designed to be capable of reducing to clinker 80 tons of domestic and trades refuse of average quality per day of 24 hours and has been tested and proved capable of evaporating 1.32 lbs. of water per lb. of refuse consumed.

The maximum combustion chamber temperature has been recorded of 2,255 degrees F., the average air pressure in the ash-pits being 2¾ in. (W. G.). The percentage of residual (clinker and ash) on the total of refuse consumed was 19 per cent.

Owing to complaints of dust and steam arising from the cooling of the clinker, a clinker shed has been erected adjacent to the destructor, in which have been provided compartments for placing barrows loaded with hot clinker. These are drenched with water taken from the adjacent cooling tower, the escaping steam being drawn into the chimney thru a flue. The clinker is afterwards tipped into the clinker house to await removal.

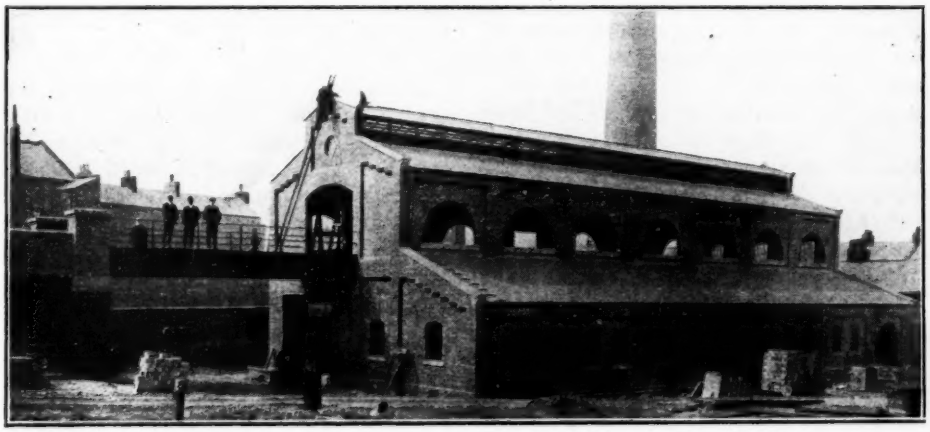
¶ THE FORCE *operating the plant works in two shifts six days a week.*

The plant is worked on an average 17 hours per day, for 6 days per week, the men working in 9-hour shifts. The staff consists of a foreman at 35s ($8.50) per week, 4 stokers at each shift at 5c ($1.22) each per shift. One charging man for the afternoon shift at 5s ($1.22) per shift. The plant is capable of dealing with all the available refuse collected in the town with the exception of the outlying portions, and this enables economical hours to be worked. Were it necessary for a 24-hour day to be worked, 25 per cent. of the heat generated could not be utilized economically.

It was originally intended when it was first decided to erect the destructor to utilize the steam for a slab-making plant and for public baths. These two ideas could not utilize anything like the amount of steam that can be generated.

In 1903 Mr. Fidler was instructed to prepare a scheme for the electrification of the Northampton corporation tramways, and recognizing the value of the destructor as a steam-raising plant Mr. Fidler advised the corporation to utilize this in their scheme, which advice they followed with the result that the capital outlay for the steam raising plant and distributing mains was considerably reduced. Steam is now supplied to the tramway power station, which has been erected on the same site, during the whole of the working day. One of the drawbacks of the utilization of the refuse destructor in connection with the steam-raising plant of the electrical power installation is the intermittent temperature, which results from the lengthy operations of charging and clinkering. To obviate this a boiler is always kept under steam in the tramway power station and steam from it is passed into the destructor steam mains, which results in an average pressure being obtained. Before entering the engines the steam passes thru a superheater placed in the back flue, which raises the steam to a temperature of 500 deg. F.

The amount received from the tramways committee for steam supplied during the past 12 months is £350 ($1,700), but it is expected that this figure will be considerably exceeded during the ensuing 12



THE REFUSE *of the city of Northampton, England, is incinerated in this high-temperature plant, entering from the left over the bridge, passing thru the furnace cells and removed as clinker on the floor below. A tall stack, shown in part, produces strong draft.*

months. This figure of £350 represents a saving in the coal bill of 35 per cent. and is a very welcome aid towards lowering the annual working cost of the destructor.

The total amount of refuse consumed per annum is about 15,000 tons. The resulting clinker is used for the foundation of footpaths on the various recreation grounds belonging to the corporation, a small portion is sold, and the remainder is carted away to tips. All irons, tins, buckets, etc., are sorted out from the refuse and a ready sale is obtained for them, the material being flattened by the use of the steam roller to make it more portable.

¶ THE ELECTRIC POWER STATION *for which the destructor supplies some steam is of large capacity.*

It may be of interest to give a few notes concerning the electric power station which consists of an engine room 63 ft. by 40 ft. by 32 ft. 3 in., a boiler house 46 ft. 3 in. by 14 ft. 6 in., store room, mechanics' shop, offices, battery room, etc., 38 ft. by 38 ft. with single storied offices, bathrooms and lavatories. There are three boilers of the "Economic" type made by Davey, Paxman & Co., of Colchester, each capable of evaporating 8,000 lbs. of water per hour. The boilers are also fitted with mechanical stokers of the Bennis type and superheaters are placed in the boiler flues capable of superheating the steam to 500 degrees F. The boilers are fitted with an induced draft plant provided with two motor driven fans and a steel stack 50 ft. high. The feed pumps are of the Weir type and the steam valves of Templar and Rance's make. The condensing and cooling plant consists of a Mirrilees-Watson condenser, capable of condensing 12,000 lbs. of steam per hour. The centrifugal circulating pumps and an Edwards air-pump are motor driven. The cooling tower is of the Klein type, about 70 ft. high. It is of timber and of the natural draft type, resting on a brick-faced tank 22 ft. by 7 ft. deep. A Paterson water softener and oil separator are provided to deal with the make-up water and oil, after the water leaves the condenser. The water supply is obtained from a well sunk on the site supplemented by town water. The water from the well is very hard and is rendered fit for steam raising purposes by the use of the water softener.

Generating Plant. This consists of two 200-k.w. sets composed of Willans compound 3-crank engine working 350 revolutions per minute, and capable of giving 360 i.h.p., and an International Electrical Engineering Co.'s dynamo. Also a compound set capable of giving an output of 120 k.w., consisting of a Willans 2-crank compound engine of 350 revolutions per minute and capable of giving 240 i.h.p., and a dynamo of the International Electrical Co.'s make.

There is also a battery made by Ashdown, Benson & Pease, of Stockton on Tees. It consists of 250 cells and is capable of giving out 170 amperes for 3 hours. There is also provided a reversible booster and milking set, both made by the International Company.

¶ A TRAMWAY SYSTEM *is operated by the power from the destructor thru the electric generating station.*

The length of the tramway system is 5½ miles, mostly of double line. There are at the present time 22 cars in operation. The car shed and tramway depot is situate in St. James End. The main building is 150 ft. long and 69 ft. wide and 19 ft. 6 in. to the tie-rods and will accommodate 30 cars. The offices, stores, etc., adjoin the building.

From the above short description the reader will no doubt be able to realize that the destruction of all waste and refuse matter collected which disseminates germs of disease besides creating intolerable nuisances, is possible without offence, and converts by the destruction all the organic particles into a perfectly inoccuous residual, which is of some utilitarian value, and at the same time the heat can be utilized to a commercial advantage, and assists one of the departments, which is nowadays recognized to be one of the duties of every up-to-date municipality, namely, the provision of a ready, cheap and agreeable means of locomotion, i. e., the electric tramways.

WATER STERILIZATION PLANTS

One of the problems in water sterilization is the removal of the excess of hypochlorite after its bactericidal action is complete. This article, from our English correspondent, describes several English plants which have installed satisfactory devices for insuring the removal of all taste and odor of the chemical from the sterilized water.

IN THE United States and Canada no special means are provided ordinarily for eliminating from the water any surplus free chlorine which it may result from the hypochlorite treatment, except that time may be given by storage of water to allow the hypochlorite to dissipate. In England consideration is given to the prevention of taste or smell in the water when it reaches the consumers, and therefore, except in a few cases of urgency, the hypochlorite treatment has been combined with a process for eliminating the free chlorine from the water after the germicidal action is complete. The process of an English firm of mechanical filter makers, consists of first dosing the water with the hypochlorite, allowing a definite time for it to destroy the bacteria and then passing the water thru a bed of prepared vegetable carbon which has the property of entirely removing any taste or smell.

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¶ DE-CHLORINATING BEDS *in a plant with pressure filters.*

Alex. C. Jarvis, an English engineer, states that in the course of perhaps two years continuous working the carbon becomes exhausted and requires renewal. Heating to redness in the absence of air, however, revivifies it. This combined chlorination and dechlorination process has been developed in both gravity and pressure systems, in plants pumping direct to consumers and in gravity supplies, in some cases combined with filtration.

One English town takes its supply from a small navigable river, the water from which, in times of flood, is turbid and colored. This water flows thru rough prefilter chambers and is then lifted by water-wheel driven pumps to the service reservoir, on the way receiving a dose of alumina and a dose of chlorine. Thence it passes thru a battery of pressure filters where it is filtered and allowed time for germicidal action. It is lastly dechlorinated, eventually reaching the reservoir, clear, bright, and almost sterile. There are no sedimentation basins and the filters run about 5 days between washings, working 24 hours per day. Of course, after pre-filtration the turbidity is not great and the quantity of alum used is small.

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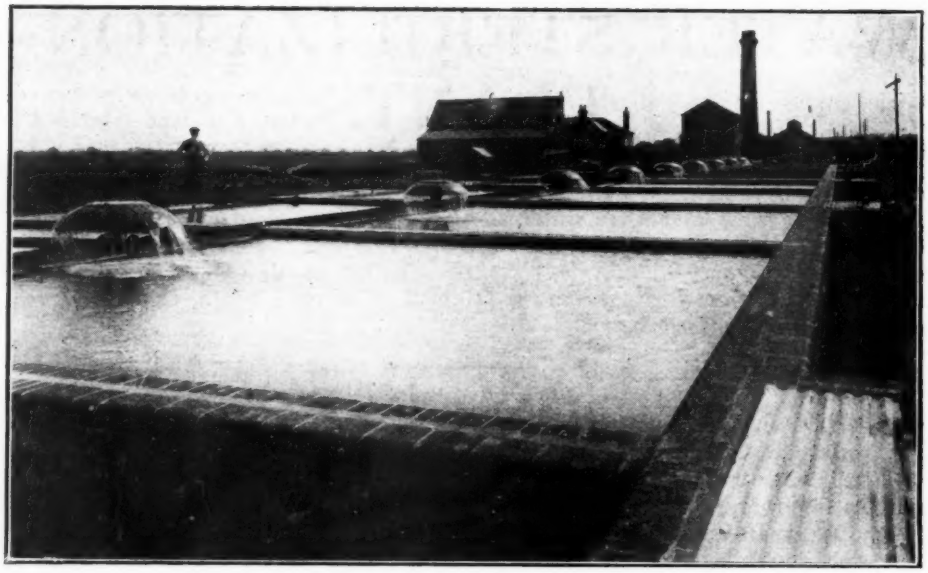
¶ THE PROCESS *applied to a plant with slow sand filters.*

In another English town the water from a stream gravitates thru slow sand filters and is then pumped to the consumers. The slow sand beds, with the greatest of care, would not produce a good water bacteriologically, and as, furthermore, the old clear water basin admitted polluted surface water by leakage, it was decided to treat the supply on the pumping main. The water passes from the pumps thru a battery of cylinders having de-chlorinating beds in the lower portion thereof, the upper portion giving the water "contact time." Hypochlorite solution is injected into the inlet main of the battery.

In still another English town the water



GENERAL VIEW *of English water purification works. Filters at farther end taken for dechlorinating plant. See drawing of plan for details of this emergency plant.*

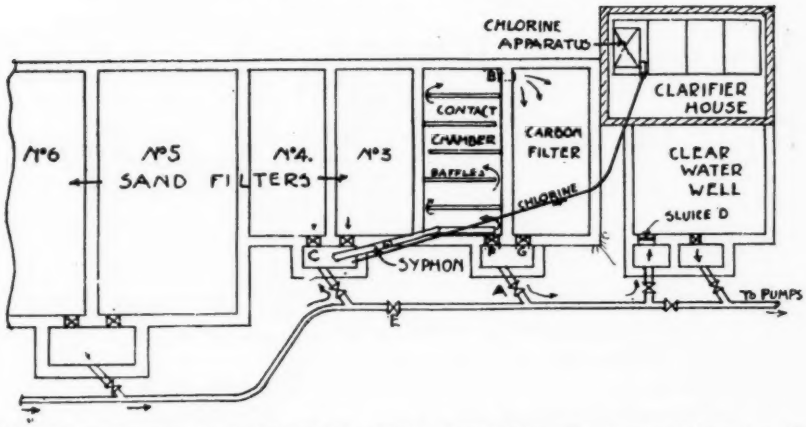
was pumped from a river thru some old cast iron clarifying boxes containing gravel into sand beds, whence it gravitated to a clear water well and was pumped to the consumers direct, the surplus being received by high level reservoirs. The supply, even after filtration, had always been more or less unsatisfactory, the river being sewage polluted and the sand bed area inadequate. The ubiquitious B. coli was very much in evidence, and when a serious typhoid outbreak occurred at a small town which discharges all its sewage impurities into the river only 10 miles above, the situation became alarming, especially as the threatened town was a high-class seaside resort which a typhoid epidemic would have ruined. The local government board called upon the water authority to take immediate action.

The difficulty was not so much in the chlorination, as in the de-chlorination of the supply. Absolute freedom from taste or smell was insisted upon, as any suspicion of flavor in the water would have started a scare immediately.

It was decided to treat the water after filtration, and before it reached the clear water well. The first four sand filter beds were small and two of these were utilized, as shown on the accompanying drawing. Filter No. 2 was entirely emptied of material and cleaned, and No. 1 was emptied down to the gravel and drains, and washed thru hose. Bed No. 2 was used as a contact or time chamber, and timber baffle partitions were put in to prevent the water running straight across from inlet to outlet, thus insuring utilization of the full capacity. A hole was cut thru the wall near the top and a 10-inch pipe was cemented in to pass the water into No. 1 bed. This bed was filled with carbon on top of the existing gravel to a depth of 2 feet, and a foot of grit and gravel was spread over it to keep it from floating up.

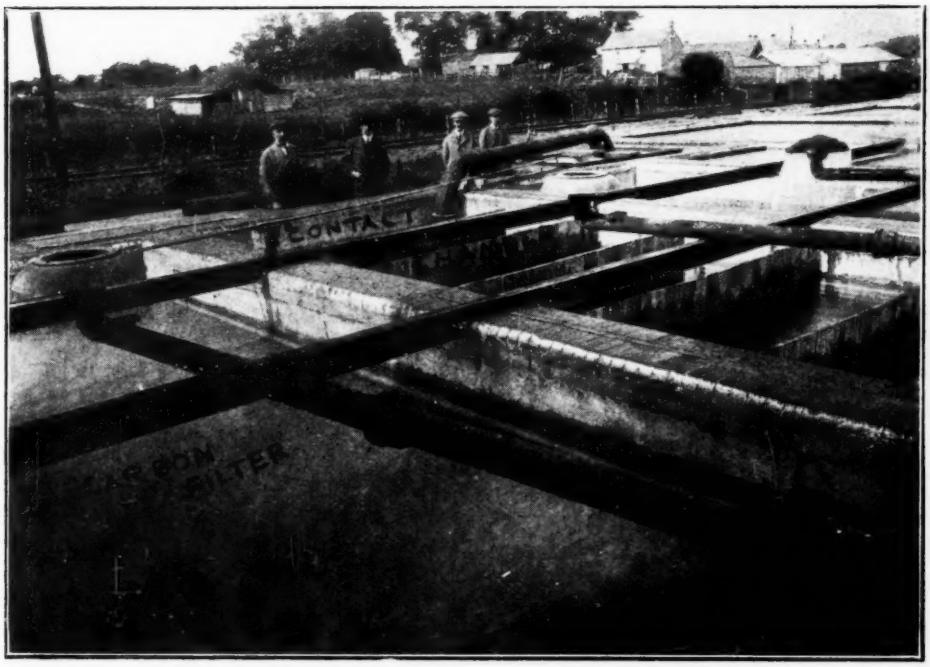
A siphon of 8-inch cast iron spigot and socket pipe was made up to connect the filtered water chamber with the contact chamber, and a small semi-rotary pump was rigged up to exhaust this siphon. The sluice was dismantled and a sheet-iron rectangular notch was put in its place with a hook gage to ascertain the flow and regulate the amount of chlorine.

Adjoining the clear water well is the clarifier house, containing the rough gravel clarifier boxes, and this was pressed into the service to house the



PLAN *of emergency dechlorinating plant. Sand filter No. 2 was taken for the contact chamber of the chlorinating apparatus and filter No. 1 was taken for the carbon filter to remove the taste and odor from the water due to the use of enough hypochlorite to insure destruction of bacteria.*

chlorinating apparatus, which was made up with a double compartment tank found on the works, a small ball-valve balancing tank, a special hand grinding mill to mix the bleach with water, and the necessary pipes, valves, and fittings. The solution was regulated by a cock on the balancing tank (with an independent cock for shutting off) and run by a funnel and wrought iron pipe (marked "chlorine" in drawing) across to the filtered water chamber. One compartment of the solution tank was in use while the contents of the other were settling ready for the following day. One part of available chlorine per million was used.



CONTACT CHAMBER, *carbon filter and siphon installed as an emergency dechlorinating plant in the works shown in the photograph on preceding page and drawing on this page.*

January, 1914

Municipal Electric Lighting Plants for Cleveland, Ohio.

By W. A. Springborn, Director of Public Service

The city of Cleveland, Ohio, is operating two small electric light plants to which it fell heir when suburban villages were incorporated in the city. W. J. Springborn, in this extract from a recent paper before the Cleveland Engineering Society, gives a clear and enthusiastic account of the greater or less success of these plants and his predictions regarding a proposed large plant which will ultimately serve the whole city.

The Brooklyn plant has been in operation long enough to demonstrate what can be accomplished with a municipal light plant. This plant came to the city thru the annexation of the village of South Brooklyn. The city began its operation on January 1, 1906. The village of South Brooklyn sold $30,000.00 in bonds for the construction of the plant. It was located on Broadview road, some distance from any railroad connection, and it cost about 40 cents per ton to haul the coal from the nearest switch. Soon after annexation additional funds were secured and the plant was enlarged by the erection of a new building in Big Creek valley, adjacent to the Baltimore & Ohio railroad. In this building was first installed a 500-k.w. steam turbine. Later on a 1,000-k.w. steam turbine driven unit was put in.

During the seven years the city has operated the plant, the earnings in excess of operation and maintenance have been put into extensions and enlargements, so that the property on December 31, 1912, had a book value of $483,934.81, less depreciation written off of $97,232.61, leaving the present net value of the plant and equipment $386,702.20. In addition to the original $30,000.00 for which bonds were issued the city has put into the property about $70,000.00 from taxes in excess of the value of the service rendered in furnishing street lights during the early years of its operation.

At the time of annexation about 100 residences were served with current and 100 street arc lights were maintained. On August 1, of this year, there were 3,262 private consumers and 1,312 arc lights were furnished and maintained.

The operation of this plant has had its influence upon the cost of street lighting in the city. The street lighting department has always paid the same rate per lamp to the Brooklyn plant that is charged by the Cleveland Electric Illuminating Company under its contract with the city for a similar service. In 1907 the rate for arc lights was $69.72 per lamp jer year. In order to forestall the enlargement of the Brooklyn plant the Illuminating Company cut its rate under its 1908 contract to $54.96. This resulted in a saving of about $40,000.00 per year in street lighting alone. Further annual reductions have been made so that now the city is paying $49.80 for arc lights.

The monthly rate for current from the Brooklyn plant is as follows: 8 cents for the first 10 units; 5 cents for the next 690 units; 3 cents for all in excess of 700 units.

The lines from the Brooklyn plant have been run as far northerly as Detroit avenue, so that a considerable portion of the west side is covered, occupied largely by the small home owners, small stores, etc. There are very few large users of current.

The receipts for the year 1912 were as follows:

From commercial lighting	$ 61,606.17
From street lighting	55,150.94
From current for power	22,889.22
Making a total of	$139,646.33

The expenses for the year were as follows:

For supervision	$ 4,354.84
Office expense	1,355.25
Station operation cost	41,849.56
Maintenance cost	30,096.02
Total	$ 77,655.67

Expressed in percentages this would be as follows:

Supervision was equal to 3 per cent. of the receipts.

Office expense was equal to 1 per cent. of the receipts.

Station operation cost was equal to 30 per cent. of the receipts.

Maintenance cost was equal to 21 per cent. of the receipts.

Making a total of 55 per cent., which is regarded by power house engineers as a very reasonable percentage of the receipts to cover all operating and maintenance costs.

The fixed charges were as follows:

For interest on the $30,000.00 in bonds	$ 1,500.00
For depreciation	13,992.15

being 11 per cent. of the receipts, thus making the total expense for the year, including fixed charges, $93,147.82, or 66 per cent. of the revenue, leaving, therefore, 34 per cent. of the revenue as profit on the year's operation.

¶ THE ECONOMY *of operating the plant is shown by the statement of output and average cost of current.*

In 1912 were generated 4,611,853 k.w.-hours, the average sale price for these being 3.02 cents. 3,766,265 k.w.-hours were sold at an average selling price of 3.70 cents. The difference in k.w.-hours generated and k.w.-hours sold represents the loss in transmission and current used at the stations, and for testing and other purposes. The average cost price for all kilowatts sold was 2.06 cents. The average cost price per kilowatt generated for depreciation, interest, etc., was 0.33 cent. The average cost price for kilowatts sold was 0.44 cent, leaving an average profit of 1 cent per kilowatt-hour generated and of 1.23 cents for all kilowatt-hours sold.

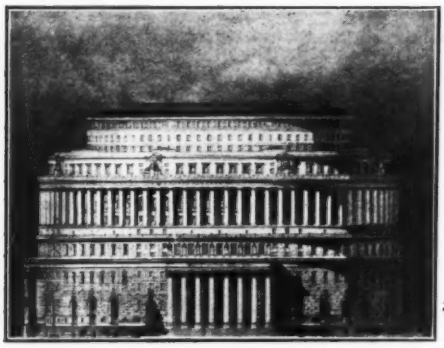
From the above it will be seen that the average sales were at less than 4 cents per kilowatt. If this can be done from a small plant of only 1,500 k.w. capacity and a handsome profit shown, it is not unreasonable to state that current can be sold at 3 cents or less from a 15,000-k.w. plant, as many of the items that enter into the cost are equally as great in a small plant as in a larger one.

¶ THE PROFITS *on the Brooklyn plant for 1913 show increase over preceding years on account of increase in consumption. The Collinwood plant is smaller and less profitable.*

Take the same plant for the first seven months of this year and the showing will be even better than last year. The receipts for the seven months amounted to $100,941.04. The total operating and maintenance cost was $53,811.74, leaving the profit $47,129.30. From this, of course, must be deducted the fixed charges for interest and depreciation. Even after this is done the profit will be greater than in the year 1912. The remaining five months will show a larger earning, due to the fact that the burning hours are longer.

The total number of k.w.-hours generated in the seven months was 3,734,436, the average sale price being 2.70 cents. The number of k.w.-hours sold was 2,768,869, the average sale price being 3.64 cents. The average cost price per k.w.-hour generated was 1.44 cents. The average cost price per k.w.-hour sold was 1.94 cents. The average profit per k.w.-hour generated was 1.26 cents. The average profit per k.w.-hour sold was 1.70 cents. The average cost price per k.w.-hour at the switchboard during the seven-month period was 0.94 cent.

The city also operates what is known as the Collinwood plant. This plant, however, is much smaller and does not show so good a profit as the Brooklyn plant, due to the fact that the equipment is old and obsolete.



A fierce contest is waging over this design for a circular court house for New York City. It has already been modified and should be adapted to the civic center plan described in this article.

A CIVIC CENTER FOR MANHATTAN

THE fact that city, county, state and federal business in the Boro of Manhattan, New York City, has outgrown the space heretofore allotted to it has given rise to a number of plans for providing the necessary accommodations in buildings which shall be of monumental character as well as of business convenience.

The federal government is building a new postoffice far up town and will soon abandon the old postoffice on City Hall square for that purpose. It is now considering procuring another site for a federal court building.

The state of New York now rents many offices in the city, the annual cost of which would go far toward paying the capital charges on a suitable site and building for them.

The county courts have been so crowded that a new site for a building for them has been purchased a block or two north of the present locations of city and county buildings, and active steps have been taken, as stated below, toward a building.

The city hall has long been inadequate, even for the limited city purposes to which it is now assigned, and the enormous sums paid for rent of offices for the thousands of city employes have been capitalized for the future and put into the great municipal office building next to the City Hall park and the Brooklyn bridge, which is now completed.

Mr. Lowell proposed a circular building

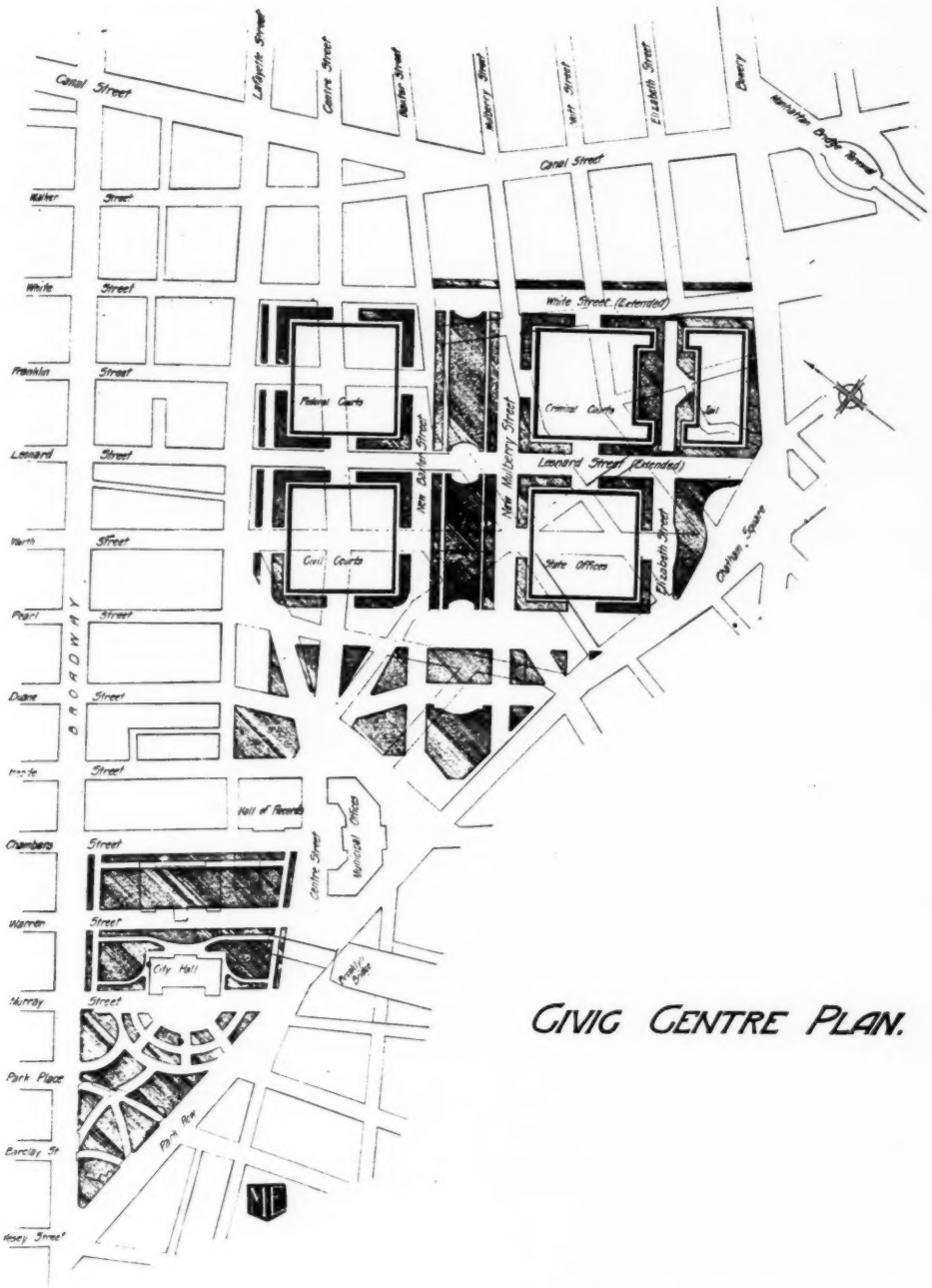
The congestion of traffic in the area between the Brooklyn and Manhattan bridges has become almost unbearable.

All these things have set men's wits to working and several schemes have been presented for relieving conditions to a greater or less extent.

¶ PLANS *for relieving the congestion and beautifying the quarter have concentrated upon one which should be pressed to adoption.*

Thus, one plan attempts only to secure a more direct and commodious passage from the Manhattan bridge plaza to the new municipal building. This would be secured by widening Canal street for four blocks to Baxter street, and widening Baxter street for one block from Canal street to the new court house site, by purchasing 100 feet width of property. This same width taken from the court house site would carry the new boulevard to its destination. The property to be acquired is assessed at $1,800,000.

President McAneny, of the Boro of Manhattan, and Alanson T. Briggs, secretary to the Court House Board, have prepared a much more elaborate plan, a



THE McANENY-BRIGGS *plan for relieving and beautifying New York's most congested and unsanitary district, lying between the Brooklyn and Manhattan bridge terminals.*

January, 1914

sketch of which is shown herewith. This plan takes into consideration the needs of nation, state, county, city and local traffic and provides for them all and at the same time makes possible a majestic and beautiful civic center which will extend without a break along Park Row, Chatham Square and the Bowery from Broadway to the Manhattan bridge approaches. This is shown in the reproduction of the sketch herewith.

The areas within the heavy black lines are the new buildings, federal, civil and criminal courts, jail and state offices.

The shaded areas are the park spaces about the new buildings and the old buildings remaining. Within this park area the buildings to be removed are shown by fine lines showing their present contours. They include the old postoffice, the buildings between Warren and Chambers streets on the north end of City Hall park, and all the buildings between the old streets shown in fine lines across the proposed new civic center.

A considerable area south of Worth street has already been purchased for the site of the new county court house, costing some $6,000,000. The property to be taken for the whole plan is assessed at $15,647,000, which is the sum necessary to secure the ground on which to build it.

GUY C. LOWELL, *the designer of the proposed circular court house.*

¶ THE PROPOSED NEW COURT HOUSE *would interfere with the new civic center plan and should be made to conform.*

A bill is now before Congress to appropriate $3,000,000 to purchase a site for a federal court house. The site of the state office building is assessed at $1,940,000; that of the criminal court and jail at $3,569,000. If the state can be induced to purchase these sites, there would remain a little over $7,000,000 for the city to raise to pay for the better street areas provided and for the park features.

This plan would leave only the old city hall in the City Hall park and would clean up what has been for many years one of the most objectionable areas in the city. It would give a breathing spot with comparatively low buildings in the midst of the forest of skyscrapers and would add incalculably to the comfort of business conditions in the most seriously congested area in any city.

This plan would be interfered with by the construction of the new court house, over the plans for which there is much controversy. This was begun over the competition for the preliminary plans, the first prize in which was awarded to Guy Lowell, a young architect of New York, one of the famous Lowell family, and cousin of the president of Harvard University.

¶ THE CIRCULAR COURT HOUSE *plan is well worked out and presents a notable solution of the difficult problem of putting a circular building to practical use.*

Mr. Lowell proposes a circular building approximately 400 feet in diameter and 200 feet high. Its general appearance can be judged from the accompanying photograph of the south elevation. Rectangular rooms in a circular building would seem to present great difficulties, but Mr. Lowell has utilized every odd space with small rooms essential to the

proper use of the building until it seems that he has saved room rather than lost any. The circular form gives more actual floor space for the same length of exterior wall, so that there is material saving in cost on this account. It has been possible by arrangement of offices, courts, judges' rooms, etc., on different floors, to serve the public doing business with the court offices on the first floor, to give the public immediate access to any court room and its appurtenant rooms, to separate spectators from those engaged in cases before the courts and to give the utmost privacy to judges, jurors and court officers requiring it.

The building would occupy the site on the civic center plan marked "Civil Courts" and there seems to be no good reason why it could not conform most acceptably with classic designs for rectangular buildings upon the other sites. A building of its dimensions will certainly show its beauties much more clearly and satisfactorily in such surroundings than it will if located on the plat provided for it alone and closely surrounded with business buildings, especially if they are as tall as are their neighbors, of which the great municipal building is but one.

¶ THE DELAY *caused by the refusal of the judges to approve the court house plan gives pause for the promotion of the civic center plan.*

The Supreme Court judges in New York city entered formal objection to the circular plan, the twenty-six judges being unanimous in requiring more light than the plans provide. They point to the gloomy court rooms in the present county court house which have light from only one side as evidence of the practical basis for their objections and to the fact that the most desirable court rooms in the present structure are those in the Eidlitz extension from the main building, which have light on three sides. Justice Dugro, the chairman of the committee of judges on the subject, himself a very competent expert on the architecture of courts, has recently visited court houses in London, Paris, Berlin and Brussels and was particularly pleased with the new courts in London, which are lighted from three sides and also from the ceiling.

Mr. Lowell, after unsuccessful efforts, seconded by Walter Cook, the consulting architect of the court house commission, to secure the adoption of his plans by the judges, has modified his circular plan somewhat, but did not adopt Justice Dugro's suggestions, because they would require an entirely new plan.

¶ THERE ARE OBJECTORS *to the Lowell court house plan other than the judges of the courts to be housed.*

Some of the architects have taken a hand in the controversy and even attack the validity of the ordinary architectural competition on the ground that the novel effects shown so convincingly by Mr. Lowell in his plan hypnotized the architects, R. S. Peabody, Frank Miles Day and J. L. Mauran, who with Mr. Cook were the jury making the award.

It is even thought probable that legislation will be necessary to resolve the difficulty, since the plans under the present law must be approved by the Supreme Court judges as well as by the Court House Commission and the Municipal Art Society, before the work can begin.

Perhaps this delay over the plans will operate to the benefit of the plans for the civic center, because they provide sufficient space and light, whereas the site for the court house now provided is insufficient to meet all the demands made by those whose opinions govern.

THE NEW WATER PLANT OF SOUTH ORANGE, N. J.

The story of the building of a new plant for supplying deep well water to a large village is one of considerable interest, especially as it tells of a successful application of the air-lift system and gives quite full detail of the cost of construction.

The village of South Orange, N. J., had a population in 1910, at the time the movement for a municipal water works was started, of about 6,000, which had doubled in 20 years.

Dissatisfaction with the service and supply of the private company, one which served several municipalities led to the development of the present deep well supply after careful studies of the situation by several competent engineers, including John J. Boyd, the designing engineer, and Nicholas Hill, Jr., and C. C. Vermeule, consulting engineers of national reputation.

A special act of the legislature giving the village the power to construct its own water plant was necessary and was obtained, together with the consent of the state water commission and the approval of the supply by the state board of health. All these steps occupied some two years and the contract for construction of the works was let late in the summer of 1912.

The completed plant is described as follows:

The pumping station is a substantial brick building, on heavy reinforced concrete foundations, with tiled roof, lined with cement and absolutely fireproof. It is in tasteful and appropriate style of architecture. Inside, the walls of the engine room are wainscoted with white glazed brick up to 8 feet from the floor. The whole interior can easily be kept clean and sweet as a water plant should always be. The stack is also a fine piece of work, of material matching the main building. A siding from the railroad brings cars directly to the coal pockets along side of the boiler room.

The machinery is in duplicate thruout, as follows:

Two 210-h.p. water tube boilers, of the Murray Iron Works manufacture, capable of operating at 190 pounds working pressure, altho normal pressure carried will not be in excess of 150 pounds.

Two cross-compound, two-stage, Meyer valve gear on the steam end, compressors of the Laidlaw-Dunn-Gordon manufacture, of the dimensions: High pressure steam cylinder, 11 inches; low pressure steam cylinder, 20 inches; intake air cylinder, 20 inches; compression air cylinder, 13 inches diameter; stroke, 12 inches. Under the well conditions as at present determined, the capacity of each of these compressors will be 1,300,000 gallons per day of 24 hours.

Two triple-expansion pumping engines, made by Epping Carpenter Co., of a guaranteed duty of 80 million foot pounds of useful work per 1,000 pounds of commercially dry steam, of dimensions: high pressure steam cylinder, 8 inches; intermediate steam cylinder, 12 inches; low pressure steam cylinder, 30 inches; water cylinder, 9½ inches diameter; length of stroke, 16 inches; capacity 800 to 900 gallons per minute, but could in emergency be increased to 1,000 gallons per minute, or 1,440,000 gallons per day of twenty-four hours.

The chimney is 5 feet in diameter at its smallest point, the top, and is built of radial brick and carried to a height of 125 feet. This has been furnished and installed by Messrs. H. R. Heinecke, Inc.

The auxiliary machinery consists of two independent jet condensers, each of sufficient capacity to condense the steam from one compressor and one pump, of the Blake and Knowles manufacture; two boiler feed pumps, each of ample capacity to supply either one of the boilers, of the Henry R. Worthington manufacture; one feed water heater, so proportioned as to take the exhaust from the condenser pump and the boiler feed pump, using the exhaust steam for heating the feed water for the boilers and raising the temperature of this water to 190 to 210 degrees F.

¶ THE DIVISION *of the plant into units is such as to make the economy of operation under any probable load a maximum.*

The whole plant is designed so that one boiler will operate one compressor and one pump. Both pumps and compressor will operate condensing, the water for this purpose being taken from the east branch of the Rahway river and returned thereto. Each unit will have a normal capacity of 800 gallons per minute, or 1,200,000 gallons per day of 24 hours; or, if only operated 10 hours, 480,000 gallons, but should it be desired, the speed of the compressor and the pump can be increased so as to deliver 1,000 gallons per minute, or 600,000 gallons per day of 10 hours. Should it be desired, more water could be pumped in less time by putting in operation the extra units of the compressors and pumps; or by operating one compressor and pump, and increasing the time of operation, the same results could be obtained.

The plant also includes a dynamo for lighting the building and grounds and the plans provide a storage battery for lighting when the boilers are shut down, and also an air tank and fire whistle for sounding alarms, the latter being connected with the fire-alarm system of the village and actuated from the boxes, the police headquarters or the fire-house.

It is not the plan to pump continuously for the present. That would require extra labor and add to the expense. The capacity of the wells and pumps is such that enough water can be raised in an ordinary working day to supply the village for twenty-four hours. The reservoir has a capacity of 2,000,000 gallons, and the ordinary daily requirements are only four hundred thousand. The reservoir will be filled and after that the daylight run of the pumps will keep the supply up to the demand. The twelve-inch main which runs from the pumps to the reservoir, is connected with the supply main of the distributing system for the village, at the corner of Lenox road and Ridgewood road. The pumps will work directly into the mains during the day, the unused surplus going to the reservoir, and after the pumps are shut down at night, the supply will be drawn entirely from the reservoir. The valves are so arranged that the reservoir may be disconnected and all the water pumped directly into the mains, or the pumps may be cut off and all the water taken from the reservoir.

¶ THE WELLS, *their depths, capabilities and locations, show the advisability of the application of the air lift.*

There are at present seven wells completed and in service. Upon completion of each well, a test was made of the quality and flow for a period of 72 hours. The record is as follows:

No.	Depth.	Flow per day.	Completed.
1	274 ft.	350,000 gal.	Oct. 28, 1911
2	276 ft.	300,000 gal.	Jan. 27, 1912
3	275 ft.	210,000 gal.	May 25, 1912
4	400 ft.	70,000 gal.	Aug. 31, 1912
5	300 ft.	288,000 gal.	Nov. 2, 1912
6	300 ft.	350,000 gal.	Feb. 15, 1913
7	300 ft.	125,000 gal.	April 26, 1913
		1,693,000	

The air lift is used in raising the water from the wells. The full dimension of the wells is 8 inches. Within this and extending down below the surface of the water about 140 feet, is a 5-inch pipe and inside that is a 4-inch pipe reaching nearly as far down. Air from the compressors in the pumping station is forced down the space between these two inner pipes to the bottom of the 4-inch pipe, thru which it rises in a series of bubbles, which lighten the water in the inside tube

so that it is pressed upward by the weight of the solid water outside, and is driven out at the top in aerated jets. At the top of each 4-inch pipe a deflector turns the water into pipes thru which it flows by gravity to a basin at the pumping station and from there the pumps deliver it to the reservoir. This method has many practical advantages. There is no machinery in the wells that can get out of order and it is capable of indefinite extension to wells at a long distance from the power house, limited only by the capacity of the air compressor. The seven wells give an ample supply of water for a number of years to come, pumping at first only in day time, and later on, when the consumption demands it, pumping day and night. Additional wells may be driven as the demand increases.

¶ THE RESERVOIR *is near the top of the mountain above all present habitations.*

The reservoir near the top of the mountain on South Orange avenue is in the shape of a truncated triangle, 255 feet long, 90 feet wide at one end, 20 feet wide at the other, and 23 feet 9 inches deep, the shape conforming to the lay of the land. It will hold 2,000,000 gallons of water, about enough for five days supply, at the present rate of consumption. It is divided in two sections, each of which can be cut off for cleaning, leaving the other for service. Its elevation will give a pressure of 117 pounds at the village hall, a little more than that of the present supply when the latter is up to normal, and it will provide constant pressure at any house now in the village. If houses should be built near the top of the mountain too high to be served from the reservoir, they can be supplied from a small standpipe set on land which belongs to the village on the mountain above the reservoir, and this can be filled by an electric pump, operated from the power house. A conduit for electric wires for telephone, lighting and power, has been laid over the main which connects the pump-house with the reservoir. The reservoir was made by excavating rock from the mountainside and lining the cavity with walls and floor of reinforced concrete. It is covered with a reinforced concrete roof, supported on steel columns, encased in cement and the top is covered with earth, and seeded in grass.

¶ LAND *sufficient to protect the purity of the water and to extend the well system has been provided.*

The board has acquired from various owners a tract in the valley, adjacent to the pumping station, of about 27 acres. It includes the low lands where the wells are driven and space for additional wells, when they may be required. It also includes adjacent land on higher ground than the wells, extending up to Walton road, and southward to Hilldale avenue. It was considered a wise policy, and it was in accordance with the recommendation of the engineers, to acquire this land and control it absolutely so as to prevent encroachments at any time in the future. The land has all been bought outright, without recourse to condemnation proceedings in any case. The tract on the top of the mountain where the reservoir is located extends back from South Orange avenue beyond the crest of the mountain and cuts off encroachments from that side. This will make an attractive public park, and it commands a magnificent view. The grounds around the pumping station and wells, will also be a public park. It will be enclosed by a fence with gates at convenient points of access.

The vital feature of the plant is the quality of the water. This is of the highest degree of purity and reasonably sure to remain so. Tests have been made from every well by three separate chemists, representing the state board of health, the village board of health and the engineer. All agree, in every case, that the water is of good quality, entirely free from any contamination. The geological structure of the ground is favorable. A section of the strata thru which the wells are driven shows that the top is a layer of earth, then a layer of clay 12 feet thick, then a layer of hard pan, then another layer of clay, about 9 feet thick,

over 30 feet in all and then 230 to 270 feet of solid rock down to the water bearing stratum. The water that is found there has no connection with the water on the surface. The engineer of the joint trunk sewer which passes near the tract, was requested to make an examination and ascertain whether there is any danger of contamination of the wells from that source. He made an exhaustive and thoro series of tests, and his report shows that there is no connection between the surface water and the wells and no cause for apprehension on that score. The geological formation is such that the overlying bed of drift and clay everywhere protects the rock strata.

¶ THE WELL TUBES *are made watertight by standard methods.*

To make the well tubes water tight, the iron pipe which comprises the top section of each well is driven down into the rock for several feet, making a close joint. Around the top of each well tube, a block of concrete was built 16 inches thick and 8 feet across, cutting off any surface water that might follow down the pipe.

The following analysis of well No. 7, on May 8, 1913, is typical:

(Results expressed in parts per million.)

Temperature	52° F.
Odor	None
Turbidity	0.5
Color (platinum standard)	15.
Nitrogen as free ammonia	.034
Nitrogen as albuminoid	.070
Nitrogen as nitrites	0.
Nitrogen as nitrates	4.0
Chlorine	10.
Temporary hardness (alkalinity equivalent to carbonate of lime)	97.0
Permanent hardness	.0
Total solids (residue on evaporation)	193.0
Loss on ignition of residue	30.0
Fixed mineral matter	163.0

Bacteriological.

Fermentation in lactose bile (10 tubes, 1 C. C. of water in each), positive, 0; negative, 10.

Litmus lactose agar	0
Red colonies	0
Bacteria per C. C.	
Growing in 24 hrs. at 37° C.	0
Growing in 48 hrs. at 20° C.	190

No deleterious chemical properties are found, and it is absolutely free from the B. coli, the sign of sewer or other excremental contamination. The bacterial count is not large. This feature is present to some extent in all water, and is not necessarily harmful. It is likely to decrease with the constant pumping of the wells.

About one-third of the floor space of the pumping station is left vacant, that the village may install an electric plant for lighting the streets when it is considered advisable to do so. The generator could be run from the same boilers as the pumps, one being operated chiefly at night and the other in daytime, or both together, if necessary, or there is space in the boiler room for another boiler, if it should be required.

¶ THE FINANCIAL STATUS *of the plant will improve as the number of users of the water increases within or without the village limits.*

At the normal consumption of water at the present rate, the earnings of the department will be sufficient to meet all charges for operation, interest and sinking fund. As the population increases and more water is used, the profits will increase with the possibility of lower rates being feasible. There is also the very imminent probability that some of our neighboring municipalities, several of which are in straits over their water supply, may look to South Orange for assistance, which could easily be furnished from the surplus available. The approximate cost of the plant is as follows:

Real estate (36 acres)	$ 70,369.84
Wells	10,697.47
Pumping station, machinery, etc.	65,564.89
Reservoir	46,694.09
Pipe lines	9,111.93
Engineering, inspection, etc.	9,223.96
Interest	6,082.00
Grading roadway, etc.	2,284.30
Miscellaneous	1,820.02
	$221,749.50

THE DESIGN OF A STREET INTERSECTION

By Paul E. Kressly, City Engineer, Inglewood, Cal.

A Practical and Individual Solution of the Problem of Designing a Satisfactory Street Intersection.

THE proper form of the surface of a pavement and the method of drainage at street intersections, are matters which in the opinion of the writer, require careful study and consideration. It is usually difficult properly to decide all the various matters that must be considered in determining the best methods to be followed, as there is no established custom among municipal engineers with regard to this, and the practice varies materially. There are, however, certain objects to be attained which govern the engineer in designing, and which must be given consideration in arriving at the proper solution of the problem in question.

The form of pavement and drainage at street intersections depends entirely upon the proper arrangement of the grades and is one of the most important parts of the establishment of a system of street grades. In order that the best results may be attained it is necessary to take into consideraton the good appearance of the street, the prompt removal of the surface water, and the convenience and comfort of pedestrians and vehicles.

In order that vehicles may pass smoothly over street intersections, the crown of each roadway should be continuous across the intersection. This condition, however, it is not always possible to obtain. Especially is this true where streets have much inclination. I have obtained satisfactory results by continuing street grades of three per cent. or less unbroken across the intersection; when grades are steeper than three per cent., the best method to follow is to break grade at the curb line and continue across the intersection at a grade not exceeding three per cent.

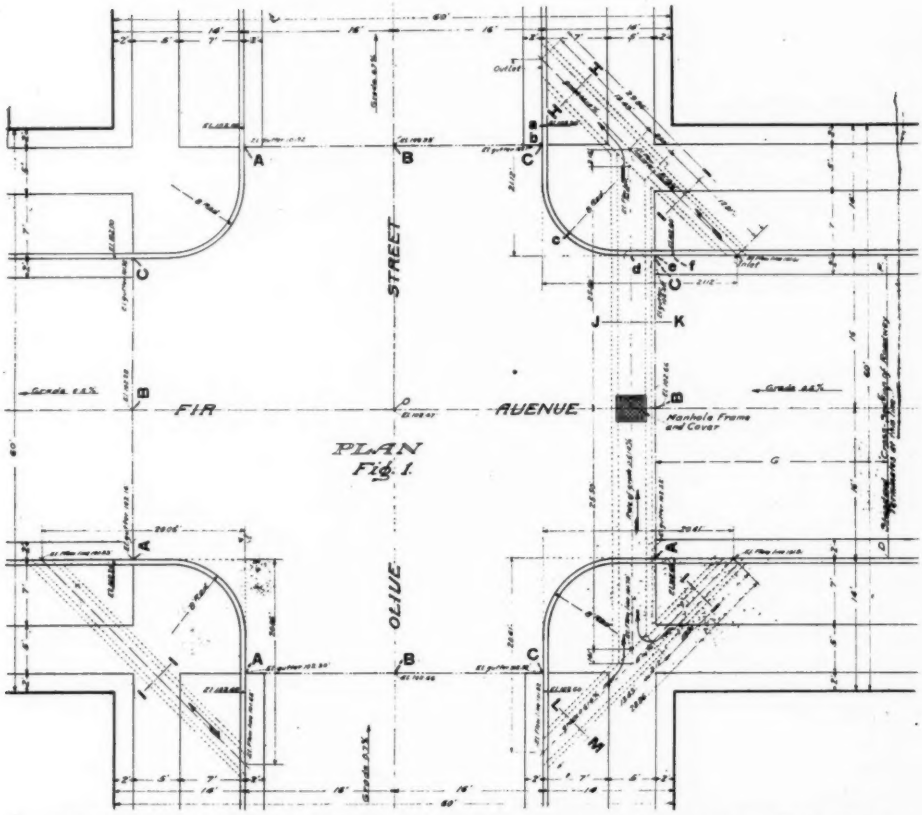
The grade between the property and curb lines should not exceed six per cent.

This arrangement of grades gives a very satisfactory form of pavement, which will not introduce side slopes at the intersections, which are troublesome and dangerous to cross, particularly for vehicles to turn the upper corners of the intersecting streets.

✠

¶ THE CROWNS *across an intersection should not be broken by open gutters running across the streets.*

The crown of either roadway should not be broken by the gutters of the intersecting street. In some cities it is a universal practice to carry the gutters across the intersections. This is objectionable at any season, particularly when the gutters are filled with snow and ice, and when the gutter and approaches to the same are so steep as to cause a violent jar to vehicles in passing over them. In fact any form or shape of gutter carried across a street intersection necessitates slowing up every time that an intersection is approached, which certainly is not very desirable, and the damage resulting to vehicles in crossing them is considerable, especially when drivers are not familiar with the location of the gutters. Another serious objection to these gutters is the rapidity with which the road metal disintegrates adjacent to the gutters, forming ruts and depressions at the approaches. It has been my experience that



A DESIGN *for an intersection with slight fall across both streets. Note the covered gutter under the sidewalk in the lower left-hand corner to take the water from Olive street to Fir avenue without running around the corner. Note the covered gutter to take the water across Fir avenue on the right-hand side and the inlets to take in the water from Olive street and Fir avenue and discharge it in the gutter of Olive street near the top of the sketch. The arrows show the direction of flow of the water.*

this form of gutter is a source of continuous expense, provided that the roadway is to be maintained in a good and passable condition, which undoubtedly is very important.

The drainage at street intersections in cities which have storm water sewers is more easily taken care of. The catch basin is usually constructed at the corner of the curbs, using inlet with a curved face. This eliminates the necessity of continuing the gutters across the intersection, and the continuous crown can be used, however, making it necessary to ease off the curves of the crowns of the two streets where they intersect, thereby requiring pedestrians to step up and down at the curbs, and follow the crown of the street in crossing. This is not desirable, as a person is liable to fall in stepping up and down at the curb. While the catch basins at the corners serve well to receive the surface drainage, this practice is very objectionable, as the surface water collecting at this point and along the line of the sidewalk and cross-walks usually forms a wide and deep channel, making it necessary for pedestrians in crossing, to either jump across or wade thru the water. This method of drainage at intersections is therefore very undesirable, and not the proper solution of the problem so far as the convenience and comfort of the pedestrians are concerned.

Some cities make better provisions to guard against accidents and discomfort to pedestrians by flattening the crown along the path of travel, and at several

feet from the curb a false curb or wall is constructed, usually at the same height as the main curb, from which a cast iron plate bridge spans the gutter to the main curb, thereby leaving a narrow channel thru which the surface water is conveyed to the inlet. This is a good method so far as eliminating the necessity for pedestrians to step up and down curbs, or across water in the gutters is concerned. However, they are objectionable inasmuch as a pedestrian is very liable to step inadvertently to the side of the bridge and fall. Furthermore, as far as the use of the carriage-way pavement or roadway is concerned, such an elevated crossing and bridge is undesirable, as it obstructs the roadway, particularly where there is considerable heavy and rapid traffic, on account of reducing the effective width of the roadway, and the bridge plates are frequently struck by wheels and broken.

✣

¶ NO SURFACE WATER *should be carried in an open gutter across the path of pedestrians.*

The inlet in such cases should always be located at one side of the line of the sidewalk or cross-walk, and provision made that the surface water running in the gutters is not carried beyond the inlet, and into the path of pedestrians. However, sufficient provision must be made to carry away the surface drainage at the intersections. This may be effected by slightly raising the grade of the roadway and sloping the surface of the intersection gradually from the center of the roadway towards the inlet. This method would naturally deviate from the continuous- crown- across- street- intersection method, but this deviation is not noticeable, nor is the elevated intersection an obstruction to travel, provided a sufficient distance is allowed to transform from the standard cross-section of the roadway to that of the special form adopted for the street intersection. This distance depends upon the increase in the amount of the crown at the center of the intersecting streets above the amount of crown for the standard cross-section.

Figure 1 shows the plan of a street intersection, with the arrangement of

THIS SECTION, *running round the upper right-hand corner from the outlet in Olive street to the inlet in Fir avenue shows the care taken to eliminate obstructions to foot travel across the intersection and to reduce the obstruction to vehicle travel around the corner to a minimum, the only obstruction remaining being the rather steep grade, 12½ per cent., from the gutter at the outlet or inlet to the raised surface next the curb, where foot travel is expected.*

Fig. 3.

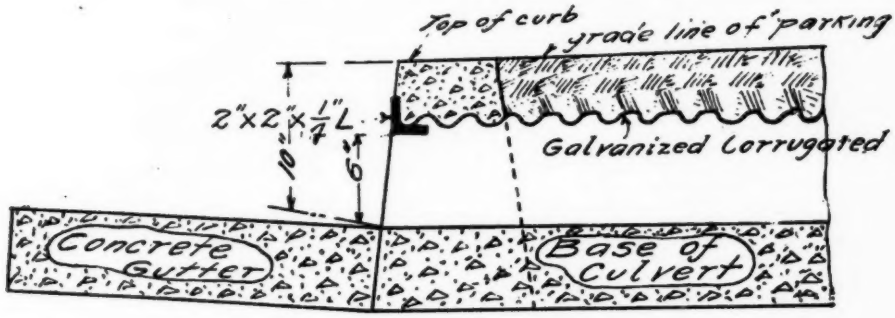
SHOWING *the special raised cross section of the street pavement on the line of pedestrian travel.*

grades, location of sidewalks, form of pavement and method of providing for surface drainage at the intersection, and of carrying the same under the roadway, by means of a corrugated iron culvert. The grades are adjusted so as to provide sufficient drainage, to impart a good appearance to the street, and give a form of pavement surface and culvert which offers the least obstruction and inconvenience to pedestrians and vehicles.

It will be seen by the elevations shown on the plan that the cross-section of the roadway is raised across the intersection, but not so much as to be an obstruction to travel. The line D, E, F, shows the termination of the standard or regular cross-section of the roadway, and the line A. B. C. shows the special cross-section at the end of the concrete gutters, which is shown on the plan to be in line with the sidewalk. Figure 3 shows a cross-section of the roadway along the line A. B. C. the different values being determined by the following formulas: x=width of roadway in feet; $x_1=x/8$; $a=x/200+.08$; $c=a\times.56$; $d=a\times.25$; $e=a\times.06$.

The cross-section between lines D. E. F and A. B. C is a transformation from one to the other, and is formed so as to coinside with the construction of the gutters and roadway surface as shown in Figure 2.

Between the points B—B along the center line of either street the grade is continuous across the intersection to the opposite line A, B, C. This arrangement of the grades of the roadway gives a good form of pavement, and one which efficinetly drains the intersection, without being an obstruction or inconvenience to pedestrians or vehicles. It will be seen in Fig. 2 that it is not necessary for pedestrians to step up and down at the curbs, nor into or across a channel of water, as this is taken care of by the inlets before it reaches the cross-walk. The construction of the gutter at the inlets and outlets is shown in Fig. 2, it being raised with a uniform slope from a point at the



Construction of culvert at inlets
Scale: 1" = 1 Foot.

Fig. 4

THE CONSTRUCTION *of the inlets to the culverts is shown of concrete, steel and galvanized iron. The outlets are of the same design.*

inlet or outlet as the case may be, to within one inch of the top of the curb in line with the sidewalk as indicated by the letters b and e.

✝

¶ THE DESIGN *of the culverts is one of the unique features of this plan of drainage of a street intersection.*

Sections, I—I, L—M and H—H show the construction of the culvert under the sidewalk and parkways, which consists of a concrete base and side walls, covered with a galvanized corrugated iron sheet of various gages as indicated, over which the cement sidewalk is constructed or the parkway fill made as the case may be.

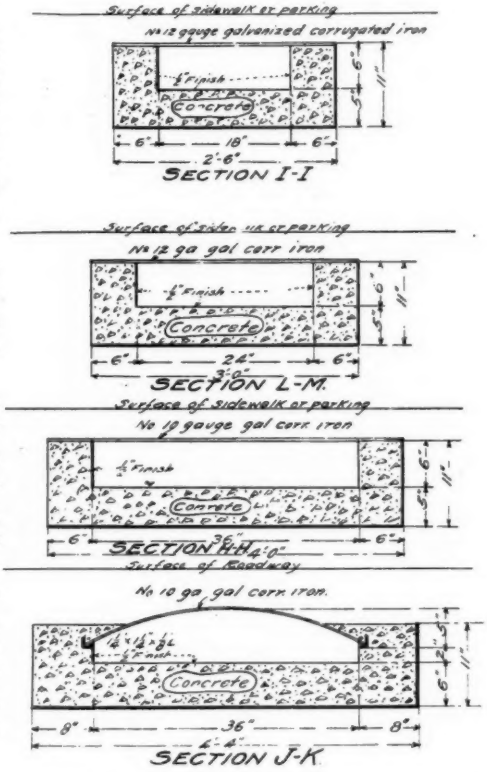
Fig. 4 shows the construction of the inlet at the curb. A 2 by 2 by ¼-inch angle-iron spans the opening, and supports the curb and the corrugated iron sheet which covers the culvert.

Wherever I deem it necessary, I require a light cast-iron manhole frame and cover to be placed at the junction of the inlets to facilitate the cleaning out of the culvert, but this is not absolutely necessary, as they can be easily cleaned with a long handled hoe from the inlet at the curb.

Section J—K shows the construction under the roadway, which consists of a concrete base and side walls, covered with a segment of a galvanized iron pipe, resting on 1¼ by 1¼ by ⅛-inch angle-iron, firmly embedded in the side walls of the culvert.

It is of the utmost importance that the galvanized iron be of the best quality obtainable, and that it should have a small percentage of impurities. There is no question but that the life and strength of this type of culvert depends upon the purity of the iron to resist corrosion. Tests have uniformly indicated that segregated impurities present in iron affect its power to resist corrosion in a marked degree.

The cost of this type of culvert construction naturally varies with different localities, and the size of culvert necessary properly to convey the surface water. I may state that during the years 1912 and 1913, there were constructed in the city of Inglewood, thirty-one culverts of this design, costing complete from $92.00 to $275.



BY REFERENCE *to Fig.* 1 *it will be seen that the first two of these sections are of the covered gutter under the sidewalk on the lower right-hand corner, and show the differences in dimensions to suit the differences in volume of water to be carried. The first section and the third show the same for the covered gutter under the upper right-hand corner, and the fourth for that under the street pavement.*

Increased Efficiencies in Electric Lamps

The most recent improvements in electric lamps are along two lines: The filling of bulbs having incandescent filaments, metallic or non-metallic, with an inert gas, such as nitrogen, under pressure; and the use of a luminescent gas, such as neon. The advantages and the probable prospects for the commercial use of such lamps are here described.

THE nitrogen-filled tungsten lamp is reported to be about ready for the market. This is a development which was made possible by the elimination of many defects in filaments, in sealing of lamps, in removal of troublesome gases from the lamps, in preventing blackening of bulbs, and of further efforts to increase the efficiency of the filaments without shortening their life. The *General Electric Review* shows the effect of these defects in such statements as that an efficiency of 0.2 watt per candle was possible for a few seconds, that efficiency as high as 0.5 watt per candle resulted in blackening bulbs within a couple of hours.

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¶ PERFECT VACUUM *not being attainable, the purpose now is to remove gases affecting filaments.*

The effort has long been to obtain a more perfect vacuum, but the results in this direction have been far from satisfactory. Then a search was made for the gases which might be affecting the filaments and it was found that water vapor is the producer of the objectionable blackening of the bulb, a very small amount of water producing a constant deterioration of the filament and increase of the blackening deposit on the bulb by transfer back and forth thru the cycle of chemical reactions.

Efficiency in the lamps could be increased by introducing gases which would prevent this cycle of chemical reactions, or by forcing the deposit at a definite place on the bulb where it would produce a minimum of damage. Both methods have been successful and the nitrogen-filled lamp is a result of the former line of experiment.

With a gas-filled bulb the filament must be run at a higher temperature than in a vacuum to get the same efficiency, and the rate of evaporation is higher, as well as the loss of heat by convection. But an increase in size of the filament increases the efficiency at the same temperature. Thus a straight filament 0.001 inch in diameter run in nitrogen at atmospheric pressure and at a temperature corresponding to that of a filament running at 1 watt per candle will give an efficiency of about 4.8 watts per candle, while a filament 0.01 inch in diameter will give at the same temperature an efficiency of 1.59 watts per candle. Winding the filaments into the form of a tightly coiled helix produces practically the same effect. Very high efficiencies can be obtained with these nitrogen filled lamps and still give the filament a life of more than 1,000 hours. The blackening of the bulb becomes a slight brownish deposit in the upper part of the bulb where it does no harm, if the bulb is properly designed.

Among the most interesting types of nitrogen-filled lamps that have been made and tested are the following:

1. *Large units of very high efficiency.* (0.4-0.5 watt per candle with a life of 1,000 hours or more.) These take currents of at least 20-30 amperes and (ex-

cept in units over 4,000 candle-power) are therefore best run from alternating current circuits by means of small transformers giving a voltage depending on the size of unit desired.

2. *Smaller units of low voltage.* These take currents of ten amperes or less, at voltages, in some cases, as low as four or five volts. The efficiencies with 1,000 hours life vary from 0.6 to 1 or even 1.25 watt per candle, according to the current used. These lamps are adapted for series street lighting on 6.6 ampere circuits (at about 0.7 watt per candle); for stereopticon lamps, automobile headlights and in general, wherever a source of high intrinsic brilliancy, steadiness and white color is needed.

3. *Lamps to run on standard lighting circuits* (110 volts). Large units of this type (several thousand candle-power) have efficiencies of 0.5 watt per candle or better. With smaller units the efficiency is ordinarily not so high.

卐

¶ HIGH EFFICIENCY, *color, brilliancy, constancy, are attributes of the new lamps.*

Besides their high efficiency, there are certain features of the new lamps which may prove of advantage for certain cases.

1. *Color of light.* The temperature of the filament being several hundred degrees higher than that of ordinary tungsten lamps, causes the light to be of a very much whiter color, so that it comes closer to daylight than any other form of artificial illuminant except the direct current arc and the special Moore tube containing carbon dioxide. The color is almost exactly like that which can be obtained for a few minutes by running an ordinary tungsten lamp at double its rated voltage.

By the use of special color screens it is possible to obtain a true daylight color at an efficiency of about 2 watts per candle whereas with ordinary tungsten lamps the efficiency obtained with the proper screens is only 10 to 12 watts per candle.

2. *High intrinsic brilliancy.* The intrinsic brilliancy is five to ten times that of the filament of the ordinary tungsten lamp. .This renders it especially suitable for projection work such as headlights and stereopticons. Altho the intrinsic brilliancy is less than that of the arc, this difference is often more than offset by the fact that the wandering of the crater of the arc prevents as sharp focusing as is possible when the source of light is fixed in position.

3. *Constancy of the characteristics during life.* Because of the freedom from blackening of the bulb in these lamps and because the helically wound filaments may be so designed that the sagging compensates other changes during life, it is possible to make nitrogen filled lamps which maintain their volt-ampere candle-power characteristics practically constant during their whole life. The ultimate failure of these lamps is due to the breakage of the filament. The candle-power is usually well above 80 per cent., even just before failure.

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¶ THE NEON LAMP *is a prospective candidate for popular favor, whose practical use is not yet possible because of some technical difficulties in making the light wholly acceptable which have not yet been overcome.*

Another lamp with great promise of high efficiency, which is not so far advanced toward practical operation on a commercial scale was described by George Claude, a French electrical engineer, before the Illuminating Engineering Society. The tube of this lamp is filled with one of the new elements, neon, which is found in small quantities in the atmosphere.

In the course of his experiments with liquid air and in separating these new elements from the air Mr. Claude found that he could so arrange his oxygen apparatus that neon was a residue of the progressive liquefaction of air and a by-product of the industrial manufacture of oxygen. He set about finding uses for this really abundant industrial product, and turned his attention to its use in producing light, on account of its luminescent properties. He found that neon refuses to act in the presence of other gases, one per cent. of nitrogen, for ex-

ample, causing a production of light due to the latter gas alone. Volatilization of the electrodes also produced trouble when the heat was too great. A charcoal filter used in the manufacturing process removes the one difficulty and large electrodes which will be heated but little by the necessary current remove the other. Tubes 6 meters (about 19 feet) long have a life of 1,000 to 1,200 hours before the neon is absorbed beyond the limit of efficiency and longer tubes with greater supply of neon have still longer life. This life is very favorably comparable with that of incandescent lamps. The illuminating power is 200 candles per meter of length of the tube, and the efficiency for the long tubes is 0.5 watt per candle. The lamp is ready to use when it leaves the factory and needs no adjustment or attention during its life.

The light is red and apparently the principal difficulty in the way of the use of the lamp for illumination is that of correcting the color. One method of correction is to use in conjunction a neon tube containing some mercury, the blue of the latter combining with the red to produce an acceptable white light. The mercury tubes have an efficiency of about 1 watt per candle, and the energy consumption of the combination of mercury and neon tubes averages 0.8 to 0.9 watt per candle.

Smaller tubes can be bent into any desired form for special illuminating effects and some of them have shown life of over 1,400 hours at rate of 30 milli-amperes and corresponding luminosity.

No commercial development of this lamp has been attempted as yet.

RECORD OF STREET CLEANING SERVICE

By C. R. Hebble, Chief Inspector, Cincinnati, Ohio.

This brief article gives a recent development of the excellent accounting service which was put in operation by the administration which is just going out of the offices in Cincinnati, O., a full description of which was given in MUNICIPAL ENGINEERING *for September,* 1913. *Mr. Hebble gives evidence in this article of the interest which city employes take in the efficiency of their departments when they can show results from their efforts to make improvements.*

SEVERAL months ago the writer made a survey of the street cleaning department of the city of Cincinnati. In examining the business procedure of the department, it was found that the district foremen, thirteen in number, were losing much valuable time because of the practice of bringing their time books to headquarters once each week, and several days later calling for them. It was also found that an office clerk at headquarters spent two days each week (payrolls were made up weekly) copying these time books into his permanent payroll record.

As Cincinnati covers 69.8 square miles, the foremen came long distances to reach the office. Instead of at once returning to their work after completing their errand to the office, many of them loafed there for an hour or two, and this was the case whether upon the occasion of bringing in their time books or calling for them. The result of this practice was that each foreman spent two half-days

each week—one-sixth of his time, acting as an errand boy, and the office clerk spent two days each week—one-third of his time, in copying the time books.

A simple expedient was adopted whereby these conditions were corrected. A time book was devised with substantially the same ruling as that in use, but with perforated pages, so that when filled out by the foreman, the pages are torn out of the book, and mailed to the office. This method has made the semi-weekly half-day excursion by the foreman unnecessary.

The law provides that each department shall keep on file a time record showing certifications that the employes had been on duty as there indicated. To avoid having the clerk copy the time books each week into such a record, the perforated pages were punched, so that after being received and checked up at the office, these pages are simply filed in a post binder. Thus, instead of having an office record copied from the time books, the *original* certified time book sheets of the foreman are on file.

Some of the foremen follow the practice of retaining every other page in their time books as a carbon copy. If desired, alternate pages can be made imperforate and of a different color, thus providing for such retention of carbon copies by the foreman.

These time books are made 8½ by 10½ inches in size, and are provided with a flexible, detachable cloth cover, in order that they can be folded over and easily carried in the pocket, and the body of the book renewed from time to time without expense of further binding.

The results of the use of the new form may be set forth as follows:

Old Way.

Thirteen foremen spent each week, one-half day bringing time books to office; one-half day calling for them. Total, one day in six.

Clerk spent two days each week copying from time books to office record.

Value of foremen's time	$2,028.00
Value of clerk's time	398.33
Car fare	416.00
Total yearly waste	$2,842.33

New Way.

Foremen use new time books with perforated and punched pages, mail sheets to office.

Clerk spends no time copying time books.

Former cost	$2,842.33
Present cost (postage only)	13.52
Value of time and car fare saved	$2,828.81

CITY OF CINCINNATI

*TIME FOR WEEK ENDING*_____*191*.

DEPARTMENT OF STREET, SEWER AND CATCH BASIN CLEANING

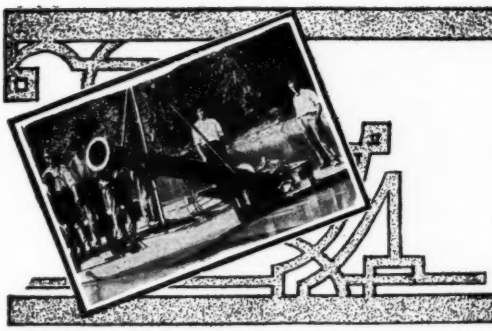
*District*_____

No.	NAME	Occupation	WED.	THURS.	FRI.	SAT.	SUN.	MON.	TUES.	No. of Days		Rate per Days	Amount

The undersigned hereby certifies to the correctness of the names, the work done, time devoted to the work, and amount due, as set forth in the above payroll; and hereby further certifies that each of the above named employes of this department from result of work performed and the personal knowledge of the undersigned, devote to the work of this department the amount of time as set forth in the above payroll.

_____

Dist. Supt. or Foreman



EDITORIAL

NEW YORK STATE HIGHWAY SPECIFICATIONS

The chaotic condition in which the New York state highway department has existed ever since the first $50,000,000 bond issue became available does not seem to be in any danger of improvement, if one may judge from recent developments.

It is true that there have been competent men in charge of the department at times, and that attempts have been made to establish efficient systems of management, but the attractions to the politicians of the job of spending $100,000,000 have been irresistible and the overthrows of systems and changes of managers have been frequent and complete.

So far as can be ascertained without inside information the percentage of graft has been small and the prospect of uncovering graft by the present investigation seems slight, but the waste of money by all these changes in system, in plans, in men, in materials, has been enormous.

The acute difficulty at the present moment is with the asphalt specifications, which, by classifying the asphalts to be used, have excluded some asphalts from certain classes tho including them in others.

The chaos which the present reorganization under Highway Commissioner Carlisle is attempting to reduce to order is not materially enlightened by the numerous propositions made to modify the specifications, especially since these are made by official and semi-official boards, committees and commissions of engineers and contractors, not working in harmony, but evidently working in opposition to each other.

The highway department appointed a board of consulting engineers nearly a year ago to prepare new specifications and methods of testing materials and to advise the department on questions arising in this field.

These specifications have been attacked by means of an inquiry following an accusation of graft in connection with the application of the specifications, which accusation has not yet been sustained.

Meanwhile the New York Department of Efficiency and Economy, an advisory body, has employed a firm of consulting highway engineers to add still another set of specifications to those already in existence. These specifications cannot be used, of course, until they are adopted by a commission of which Mr. Carlisle is a member.

It is perhaps not surprising that Mr. Carlisle, who is an attorney and not an engineer, should fall back upon the old plan of guarantee of the pavement for a term of years, for which plan the first American asphalt company was originally responsible. But this should not be permitted without a protest from the engineers who, after more than forty years of study of asphalt and its use in pavements, have learned from sad experience that this is not the way to get good pavements, and opens ways to favor contractors without danger of graft inquiries, and, indeed, with honesty of purpose. Such reversion to the discredited practices of the early "dark ages" of the asphalt industry is wholly inexcusable and cannot last longer, if adopted, than has any other plan, good or bad, which has been adopted at any time by the New York state highway department, by whatever name it may have been known.

HIGHWAY MAINTENANCE IN INDIANA.

The last Indiana legislature passed a law governing the maintenance of county highways which had behind its preparation a definite plan for a patrol system under competent county management and state supervision, but in its passage thru committees and the legislature itself, not to mention the hands of the invisible (tho apparent) control, all of the specifications for qualifications and checks upon competence and honesty of work were carefully removed. The result is a law by means of which a capable and honest board of county commissioners, thru the appointment of a technical expert on road maintenance, who is at the same time a competent superintendent and an honest man, can secure good results in the maintenance of the existing highways at as low cost as the character of their construction and the amount and kind of traffic over them will permit.

On the other hand, the new office of county road supervisor can be used simply as the means of distributing political patronage, thru the appointment of the patrolmen and the purchase of tools and supplies.

The compensation of the county road supervisors is low, $4 or $5 a day, and one board gave as a reason for not considering the appointment of an engineer that a competent engineer could not be obtained at this rate. This was disproved by the applications received in response to an advertisement published by a good roads committee, but still leaves the appointment to be made from the ranks of the political workers rather than the expert road workers.

The appointments will be made early in January, 1914, and promise to show the real need for the provisions for competence and safeguarding of expenditures so carefully eliminated in framing the law. The first year of operation under the law will provide the evidence of the necessity of materially revising the law in these respects.

THE QUESTION DEPARTMENT

City Planning in the United States

Will you please furnish me, if you have the information available, a list of the cities of the United States of more than 100,000 population which have undertaken city planning in one form or another. I should also be pleased to have any references you can give to any publications on this subject.

D. R. LYMAN, Chief Engineer,
Louisville, Ky.

Philadelphia, Cleveland, San Francisco and Washington have large plans for improving and beautifying their cities, on which they have made material progress.

Chicago, St. Louis, New York have such plans, which are still in the formative state.

New York, Pittsburgh, Seattle, St. Paul, Brooklyn, New Orleans and some others have large ideas in mind and whenever more or less extensive improvements are made they take into consideration the principles of proper city planning in deciding upon the plans for such work.

This list does not include the numerous smaller cities which are doing much planning and some work in carrying out plans for beautifying themselves on a scale commensurate with their sizes and importance, nor does it include such cities as Gary, begun with bare land and intended to attain a size much above 100,000, nor additions to large cities, such as Roland Park, Baltimore.

The annual reports of the Conference on City Planning are excellent sources of information; Flavel Shurtleff, secretary, 19 Congress street, Boston, Mass.

Books of more or less interest in this connection are: Robinson's "Width and Arrangement of Streets" ($2); "Improvement of Towns and Cities" ($1.25); "Modern Civic Art" ($1.25), and his several reports on plans for city improvements in such cities as Denver, Los Angeles, Oakland and smaller cities, not included above because no very appreciable progress has yet been made toward extensive work upon them; Zueblin's "American Municipal Progress" ($1.15); Marsh's "An Introduction to City Planning" ($1); Solotaroff's "Shade Trees in Towns and Cities" ($3); Howe's "European Cities at Work" ($1.65); Nolen's reports on plans for individual cities, four of which he has gathered into one book.

The "Town Planning Review" is a quarterly published under the auspices of the University of Liverpool, Eng., which keeps pace with the advances, particularly in Europe.

Articles in MUNICIPAL ENGINEERING of some note are: "City Planning in Vienna," vol. xli, p. 21; "The Relation of Technical Men to City Planning," vol. xli, p. 453, giving a list of cities and towns considering the subject and the names of persons particularly connected with the projects; "The Chicago Plan Commission," vol. xlii, p. 135; "Making and Correcting City Plans," p. 169; "City Planning Congress at Duesseldorf, Germany," p. 183; "A Problem of the Growing City," p. 212.

Municipal Garbage Reduction and Destruction Plants

We would like to have a list of the municipal garbage reduction plants in this country, and also of the municipally owned garbage destruction plants in the country.

R. G., St. Louis, Mo.

Most of the garbage reduction plants are owned by private parties. Cleveland and Columbus, Ohio, are the only cities owning and operating their garbage reduction plants, while there are nearly 100 cities which let the reduction of their garbage or dead animals or both by contract.

On the other hand the garbage destruction plants are nearly all of them owned and operated by the city. Following is a list of the plants in cities of 30,000 population or more which incinerate garbage alone or in combination with dead animals or rubbish, or both:

New York, 6 plants in Queens and Richmond; Buffalo, N. Y.; San Francisco, Cal., new system under construction; Milwaukee, Wis.; Minneapolis, Minn.; Los Angeles, Cal., new system under discussion; Seattle, Wash.; Portland, Ore.; Atlanta, Ga.; Scranton, Pa.; Memphis, Tenn.; Richmond, Va.; Grand Rapids, Mich.; Lowell, Mass.; Spokane, Wash.; Trenton, N. J.; Camden, N. J.; Dallas, Tex.; Salt Lake City, Utah; Yonkers, N. Y.; Youngstown, Ohio; Duluth, Minn.; Houston, Tex.; Waterbury, Conn., owned

by city and operated by contract; Evansville, Ind.; Norfolk, W. Va.; Erie, Pa., new plant just put in operation; Ft. Wayne, Ind.; Johnstown, Pa.; Jacksonville, Fla.; Covington, Ky.; South Bend, Ind.; Allentown, Pa.; Canton, Ohio; Lancaster, Pa., owned by city and operated by contract; Sacramento, Cal.; McKeesport, Pa.; Wheeling, W. Va.; Macon, Ga. Additions are made to this list each year.

Small Cities Having Water Works Plants

Can you give me a list of towns in Illinois and nearby States that have water works plants? M., ———, Ill.

The following list of water works is reasonably up to date for the two States named for small cities, towns and villages, additions being made from year to year:

Under Municipal Ownership.

ILLINOIS—Batavia, Beardstown, Braidwood, Clinton, Collinsville, Du Quoin, Geneseo, Granite, Harlem, Havana, Hoopeston, Jerseyville, LaGrange, Maywood, Mendota, Metropolis, Morris, Normal, Olney, Paxton, Princeton, Savana, Sycamore, Taylorville.

WISCONSIN—Berlin, Ft. Atkinson, Grand Rapids, Hudson, Kaukauna, Platteville, Port Washington, South Milwaukee, Sparta, Stoughton, Two Rivers, Waupun.

Under Private Ownership.

ILLINOIS—Carbondale, Carlinville, Edwardsville, Effingham, Galena, Mt. Carmel, Pontiac, Shelbyville.

WISCONSIN—Antigo, Beaver Dam, De-Pere, Menomonee, Monroe, Prairie du Chien, Rice Lake, Ripon, Whitewater.

Grouting Brick Pavement in Cold Weather

We are putting in some brick paving with grout filler, and the grouting is a rather hard proposition to manage at this time of year. Will you please tell us the most practical way of protecting the work from the effects of freezing? Would be pleased to pay a reasonable price for a good set of specifications. P., ———, Ill.

Brick pavement should not be laid in freezing weather, but if it must be laid in cold weather the grouting should be done during hours when the temperature is well above freezing and no more grouting should be done than can be protected properly from freezing during the night. The area grouted should be covered with sand as soon as the cement has set sufficiently to permit. For this reason grouting should be stopped some time before the lowering temperature as the sun sets reaches the freezing point. It may be necessary to put an inch or even two inches of sand on to protect the cement thoroly. Some contractors go to the expense of spreading tarpaulins and thus further protecting the cement until it is beyond injury from frost.

The standard specifications of the American Society of Municipal Improvements, including those for brick pavements, can be obtained from the secretary, 702 Wulsin building, Indianapolis, Ind., for 25 cents. The specifications for brick pavement of the National Paving Brick Manufacturers' Association can be obtained of the secretary, B. L. E. building, Cleveland, Ohio, upon request.

These sets of specifications are much alike except as to a few details and both represent standard methods of construction.

Tapping Water Mains Under Pressure

I understand that there is now on the market a machine for inserting gates in water mains without shutting off the water. This city contemplates the purchase of such a machine, if one can be secured which is thoroughly practical. We will appreciate any information along this line, with names of manufacturers of such machines. W., City Engineer, ———, Mich.

Information about machines for tapping water mains under pressure and modifications of some of them for inserting gate valves can be obtained from Hays Mfg. Co., Erie, Pa.; Lennox Machine Co., Marshalltown, Iowa; A. P. Smith Mfg. Co., East Orange, N. J.; Coldwell-Wilcox Co., South Water street, Newburg, N. Y.

Form of Electric Light Franchise

Would you send me form of franchise for electric lighting plant? This city is about to put in a plant and would like all the information it can get on the subject. B., Mayor, ———, Ill.

In MUNICIPAL ENGINEERING, vol. xliii, p. 322, will be found the portion of a franchise covering the public utilities for a small Illinois city, which refers particularly to electric lighting. It has some provisions which are not common, tho they are used elsewhere, and which safeguard the interests of both parties to the contract at the same time that they do not give any undue advantage to either party and give frequent opportunities to bring requirements and rates down to the conditions developing in the future.

Maker of Elk Portland Cement

Kindly furnish us the name and address of the company manufacturing Elk portland cement. J. L., ———, Wis.

Elk brand of portland cement was manufactured by the Elk Cement and Lime Company, Elk Rapids, Mich. The latest

report at hand indicates that the plant is closed and has been closed for some time. The British Columbia Portland Cement Company, Vancouver, B. C., Canada, is a new company which is now or shortly will be ready to supply cement for which it proposes to use Elk as the name of the brand.

Durability of Sidewalks

Can you give me any information as to the relative cost and durability of the so-called permanent sidewalks, such as cement concrete, tar concrete, brick, crushed stone, etc.?
G. C. B., Winter Harbor, Me.

A properly constructed cement sidewalk on a street of any but the heaviest traffic is practically indestructible. Very few streets have such heavy traffic that the cement sidewalks must be renewed within perhaps a hundred years, except at such points of excessive wear as the entrance to a well-patronized and large store or office building or a street crossing. If a cement sidewalk goes to pieces it does so ordinarily within the first few years after it is laid and because it was not properly designed or constructed or the materials were poor, all of which reasons can be eliminated by proper engineering design and supervision.

Tar concrete sidewalks on streets of lighter traffic have lasted perhaps fifty years, with evidence of further long life. The tar is not so permanent as cement in its characteristics and repairs must be made more often. It is also harder to get good materials and good workmanship and so the proportion of good and permanent walks is less than if cement concrete is used.

The durability of a brick sidewalk depends directly upon the hardness and toughness of the brick used and is indefinitely long or very short, according to whether vitrified brick similar to street paving brick or soft building brick are used, with the many other grades of brick and of durability between.

The only other difficulty in laying a permanent brick walk is in making the foundation permanent so that the brick surface will remain smooth and the edges of the bricks will not be thrown up to receive undue wear. Indeed, the main expense of laying a permanent brick sidewalk, granted hard, tough brick is used, is in supplying a permanent foundation.

Crushed stone makes a good park walk when the foot traffic is very light, but the main walks in a park should be made of harder material. Such walks require more frequent repair, and it is difficult to prevent slight muddiness or development of slight depressions holding water. Such material should be used on streets only where the traffic is very light.

In cold climates, where frost goes deep into the ground, foundations must be thoroly drained and protected from the infiltration of water or from the effects of swelling of adjacent soil as the frost goes out, otherwise walks of any of the materials named will be unsatisfactory at times.

Cost of Moving Stairways

I desire to obtain information regarding the cost of installation and the cost of operation of moving stairways, particularly those operating outside, taking the place of lifts for carrying pedestrians from a lower to a higher elevation. Will you kindly advise me of firms handling this class of equipment. L., City Engineer, ———, Can.

The moving stairways seem now to be mainly under the control of the Otis Elevator Co., Twenty-sixth street and Eleventh avenue, New York, and they can give full information. The Reno Inclined Elevator Co., 553 West Thirty-third street, New York, is also listed as manufacturing escalators.

Area Calculator of Large Capacity

We have Smoley's Tables, which run from zero to 50 feet, but we want a calculator which runs from zero to 100 feet, advancing by thirty-seconds of an inch. Is there such a calculator or book of tables?
W., Warren, O.

The writer knows of nothing of the capacity mentioned. Can our readers refer our correspondent to anything in print or in manuscript which will meet his needs? There are tables in Smoley running to 100 feet.

Automatic Exhaustion of Air from Summit of Water Works Siphon

Some time since an article appeared in MUNICIPAL ENGINEERING relative to a device for automatically tapping or taking care of any air that at times accumulates at the apex of a syphon. I wish you would give me the number of the issue of your paper in which such article appeared.
F., Houghton, Mich.

A method of automatically taking care of the air collecting at the summit of a 16-inch water works siphon is described by Howard A. Dill in a paper on "A Large Water Works Siphon" in MUNICIPAL ENGINEERING, vol. xxxiv, p. 340. It consists of an air compressor operated by a 2-h.p. electric motor, which is switched on and off by a float in a 40-in. by 12-ft. boiler shell in which the air from the summit of the siphon collects, thus changing the level of the water in the boiler shell. The compressor exhausts the air from the boiler shell when the motor is turned on by the lowering of the water level, and stops action when the water level rises to the top of the boiler shell.

Specifications for Vitrified Sewer Pipe

Will you kindly give us your specifications involving the use of vitrified sewer pipe for drainage and sewerage purposes?

THE VITRIFIED CLAY INDUSTRY,
JNO. L. RICE, Secretary,
Columbus, Ohio.

The American Society of Municipal Improvements is now working upon the subject of specifications for sewer construction. The sub-committee on sewer specifications is composed of E. J. Fort, chief engineer of sewers, Brooklyn, N. Y.; Rudolph Hering and A. J. Provost, consulting engineers. They presented a report at the Dallas convention, which was printed in the volume of proceedings for 1912 ($2). This report is now under discussion by the society and was amended somewhat at the Wilmington convention, the proceedings of which are not yet published.

The specifications concerning vitrified pipe as they stand at present are given below, but they are subject to still further amendment before adoption by the society, and the sub-committee desires criticisms of these specifications in time to present to the next convention to be held in Boston in October, 1914. Such criticisms should be sent to Charles Carroll Brown, secretary A. S. M. I., 702 Wulsin building, Indianapolis, Ind.

VITRIFIED PIPE SEWERS.

Vitrified Pipe.

Vitrified pipe sewers shall be built of shale or clay hub and spigot pipes with deep and wide sockets. The pipes shall be manufactured at a suitable temperature, to secure a tough, vitreous material, without warps, cracks or other imperfections, and shall be fully and smoothly salt-glazed over the entire inner and outer surfaces, except that the inside of the hub and the outside of the spigot may be unglazed for two-thirds the depth of the hub. On all other portions of the pipe the glazing shall completely cover and form an integral part of the pipe body. If not left unglazed the inside of the hub and the outside of the spigot shall be scored in three parallel lines extending completely around the circumference.

When it is broken, vitrified pipe shall show dense and solid material, without detrimental cracks or laminations; it shall be of such toughness that it can be worked with a chisel and hammer, and when struck with a hammer it shall have a metallic ring.

Identification Marks.

Each pipe shall have clearly impressed on its outer surface the name of the manufacturer and of the factory in which it was made.

Shape and Dimensions.

The sizes of the pipes are designated by their interior diameters. Each pipe shall be a cylinder with a circular section, and shall have a uniform thickness.

The minimum lengths, thicknesses, depths of hubs and annular spaces for the respective sizes of vitrified pipes shall be as follows:

Size, inches.	Length, feet.	Thickness, inches.	Depth of socket, inches.	Annular space, inches.
6	2	5/8	2½	5/8
8	*..	¾	2¾	5/8
10	*..	7/8	2¾	5/8
12	*..	1	3	5/8
15	*..	1¼	3	5/8
18	*..	1½	3½	5/8
20	*..	1 2/3	3½	5/8
22	*..	1 5/6	3¾	5/8
24	*..	2	4	5/8
27	**..	2¼	4	¾
30	**..	2½	4	¾
33	**..	2⅝	5	1¼
36	**..	2¾	5	1¼
42	**..	2½	5	1¼

* Not less than 2 feet. ** Not less than 2½ feet.

Curves, Bends, Etc.

Where curved pipes are required they shall be furnished in either one-eighth or one-quarter bends of their respective sizes. Curved pipe, bends, siphons and special pipe of the sizes and forms shown on the plan shall be furnished and laid, and unless otherwise provided they will be paid for at the contract prices for the corresponding sizes of vitrified pipe sewers.

Samples for Testing.

Any or all of the following tests may be applied to samples selected by the engineer from the pipe delivered on the work. For the purpose of making such tests as may be required the contractor shall furnish and deliver, where directed, and at the place required, one length of pipe for each 200 feet of pipe sewer to be laid.

Crushing Tests.

When supported at the bottom upon a knife edge one inch in width in such manner that an even bearing is provided thruout the whole length, exclusive of the bell, and pressure is applied at the crown uniformly thru a similar knife edge, the various sizes of pipe shall withstand the following pressures:

Diameter, inches.	Pressure, lbs. per lin. ft.	Diameter, inches.	Pressure, lbs. per lin. ft.
6	900	22	1750
8	900	24	1950
10	1000	27	2150
12	1050	30	2350
15	1250	33	2500
18	1400	36	2800
20	1550	42	3200

Drop Weight Test.

When supported on a dry sand bed 2 inches deep, all pipe shall withstand without cracking the impact from two blows of a cast iron ball weighing 8 pounds falling 18 inches. Spurs shall resist without fracture the impact from two blows of such a ball falling 6 inches and striking on the extreme end of the hub of the spur.

Hydrostatic Test.

When subjected to an internal hydrostatic pressure of 10 pounds per square inch, vitrified pipe shall show no percolation.

Absorption Test.

After having been thoroly dried and then immersed in water for 24 hours, sample pieces of vitrified pipe about 10 square inches superficial area with all broken edges shall not absorb more than 5½ per cent. of their weight of water.

Factory Rejection.

The entire product of any pipe factory may be rejected when, in the judgment of the engineer, the methods of manufacture fail to guarantee uniform results, or where the materials used are such as produce inferior pipe, as indicated by repeated failure to comply with the tests herein specified.

Cost of Operation of Water Works Plants

I need reliable statistics on the cost of operating water works, especially which is more successful, private or municipally owned plants, and why? The cost of reading meters and of collections is another piece of information needed.

O. E. N.,
Chicago, Ill.

The comparison of the cost of operating water works plants under public and under private ownership is difficult on the one hand because of the lack of information regarding the cost of operation of private plants, because of their objection to making public their financial matters; on the other hand, few municipal plants keep records in such shape that the information desired can be obtained from them, tho the general results can sometimes be found even if the details are lacking.

A large number, tho by no means all of the municipal plants, publish annual reports from which the information can be derived by careful study supplemented by information as to appropriations made by the city or taxes collected or bonds sold for the benefit of the water works which are accounted for in some city office other than that of the water works.

Again, comparisons can not be made because the conditions in plants are not the same and the results of equally competent management may not be equally favorable.

Some help may be derived from the following articles in MUNICIPAL ENGINEERING:

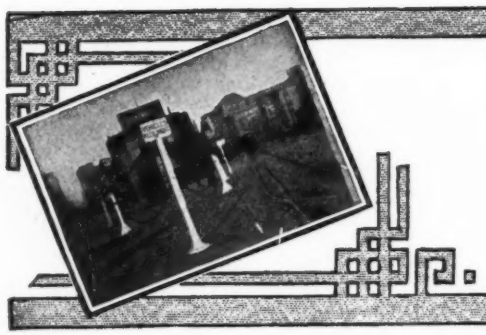
In vol. xlv: "Municipal Light and Water Plant at Fremont, Neb.," p. 119; "Water Works for Marceline, Mo.," p. 160; "Advantages of the Meterage System," p. 161; "Classification of Water Consumption," p. 283; "Water Meters as Handled by the Water Meter Department," p. 369; "Pumpage Reduced One-Half by Meters," p. 390.

In vol. xliv: "The Meterage System," p. 252; "Failure and Success in Municipal Ownership," p. 299; "Municipal Lighting Plant Operated by Oil Engine," p. 311; "Sewage Disposal and Water Supply at Duluth, Minn.," p. 347; "A System of Water Works Accounts," p. 354; "Municipal Plants in Small Towns," p. 371; "Efficiency in the Pumping Station," p. 405; "Eugene, Ore., Municipal Light and Water Plant," p. 427; "A Logical System of Meter Rates," p. 440; "Pasadena Municipal Lighting Plant," p. 504, because it gives a method of investigating the figures given in reports; "Water Works of Daytona, Fla.," p. 550; "Seattle, Wash., Municipal Light and Power Plant," p. 556; "Selling Water at a Profit," p. 580.

In vol. xliii: "Price of Electricity for Pumping City Water Supply," p. 180; "Statistics of Water Supplies," p. 390, giving references to other articles and books, some of which treat the subjects here considered.

These articles will give also suggestions of places to find still fuller information regarding any points not completely covered. There are many more in earlier volumes.

The annual reports of the cities using the standard form of water works reports should be of some assistance in studying these questions and in finding sources of fuller information. The form of the report and a statement of the names of cities using it can be obtained from the New England Water Works Association, 715 Tremont Temple, Boston, Mass.



WORKERS IN THE FIELD

Unreliability of Cost Report

The Editor of MUNICIPAL ENGINEERING:

Sir—Amplifying your editorial answer to inquiry under heading, "Cost of Various Kinds of Pavements," page 448 of your November issue, in which you point out the unreliability of figures unless accompanied by full statement of local conditions, I beg to call special attention of your readers to the unreliable, although correct, quotation given as the cost in Southern cities of bitulithic pavement, which is given as "$1.65 to $2.36" per square yard. These simple figures mean nothing to the reader more than to probably give the impression to those who are paying the normal, proper price, that they must be paying too much, because some other unnamed city is receiving presumably the same construction at materially less cost. The fact is that no city in the South or elsewhere has ever secured bitulithic pavement, including foundation, at a price nearly as low as $1.65 per square yard. Assuming your record and report of the "cost per square yard" to be correct, the lower price named must be for surface only—perhaps surfacing macadam. Doubtless the low prices quoted as to other kinds of pavement are subject to some similar explanation, and the high prices caused by other extraordinary conditions. Such brief quotations, therefore, are worse than useless, mystifying instead of enlightening. It would generally take a full page or more of your magazine to intelligently differentiate between the "cost per square yard" in any two cities, or sometimes even on two streets of the same city. How futile and useless, therefore, is the attempt which is frequently made by government reports and engineering periodicals to tabulate costs in various cities under widely varying conditions.

Take item of grading, for instance. In some cases this is paid for at a price per cubic yard and sometimes included in the price paid "per square yard of pavement," and varies in depth from 6 inches to 6 feet, in case of excavation from stone to hardpan, in length of haul from one block to three miles, and in cost of teams from $4 to $8 per day. Under such varying conditions a quotation either "per cubic yard" or "per square yard" is worse than meaningless to one who receives the quotation, unless accompanied by much more detailed and intelligently collected reported information than would be of interest to the general reader, and therefore more minute than any journal can be expected to collate and report. So with every other item—foundation, surface, etc.—the costs vary very widely with variation in character of work, depth, length of haul, local cost of labor and material, terms of the payments and a multitude of conditions varying not only in every city, but, to a less degree, in different streets of the same city.

GEORGE C. WARREN,
Boston, Mass.

Incinerating Plants Producing Power

In further reply to the question under the above heading, on p. 448 of the November number, letters have been received from which the following are taken:

The Editor of MUNICIPAL ENGINEERING:

Sir—We wish to inform you that the incinerating plant of Minneapolis has been furnishing light and heat for a number of years in a satisfactory manner, as outlined in our booklet. It is needless to say that the Minneapolis plant is equipped with the Decarie incinerators, and we can send you a number of reports showing economy in operation.

DECARIE INCINERATOR CO.,
Minneapolis, Minn.

The Editor of MUNICIPAL ENGINEERING:

Sir—In regard to inquiry in your November number regarding incinerating plant producing power, we have now in several bids for the construction of plants using my incinerator and steam generator, on which our guarantee reads, "When fired to capacity with the ma-

terials named in specifications, we guarantee this boiler to generate 150 h.p. of live high-pressure steam at 100 lb. pressure, and to drive a General Electric turbo-generator, run condensing, capable of lighting 150 to 175 street lamps of 500 watts," and this guarantee has full financial backing.

J. B. HARRIS, M. D.,
Nashville, Tenn.

Cities with Commissions and Business Managers

The Editor of MUNICIPAL ENGINEERING:

Sir—I note in the article on "Commission Government," on p. 502 of the December number, you mention Forest Park as under the commission plan, and also the city manager plan. Evidently the writer has confused the names of River Forest and Forest Park.

Forest Park has commission government, but no manager. River Forest has a city manager, appointed by the village board.

KARL M. MITCHELL,
General Superintendent,
River Forest, Ill.

Mr. Bradford, the author of the article referred to, has sent corrections of the list of cities, showing that Forest Park, Ill., Millville, N. J., Spokane and Tacoma, Wash., have the commission form of government, but do not have city managers, and that Phoenix, Ariz., should be added to the list of cities with commission form of government which also have city managers.

Pasadena's Electric Light Plant

The sixth annual report of the municipal lighting works department for the year ending June 30, 1913, has been issued and shows the same excellent results of operation which have already been published in articles upon this plant in MUNICIPAL ENGINEERING. Increases have been general and are in the neighborhood of the figures of 12.3 per cent. increase in receipts from street lighting to 20 per cent. increase in kilowatt hours sold, outside these general limits of increases being the increase in commercial light sold of 3.13 per cent. and in commercial power sold of 69 per cent. The gross receipts increased 12.5 per cent. but the net receipts increased 22.3 per cent., showing a material increase in profits.

The net value of the plant after allowances are made for depreciation is now $504,564.98. The average rate of the depreciation allowed is 4.034 per cent., a very reasonable allowance. About 23 per cent. of the cost of the plant was raised by taxation but this is carried as a book indebtedness of the plant and is fully considered in computing the results of operation. The surplus of the year's operations after allowing interest on the total average investment and the depreciation for the year is $23,558.09, making the total surplus $41,749.16.

New construction during the year cost $55,968.56.

The private company operating in the city owns plants in a number of other cities in Southern California, including Los Angeles, and has been reducing rates in Pasadena at intervals to keep them below those of the municipal plant, which in turn have been reduced far below those charged by the private plant before the municipal plant was built, so that a saving to the citizens of $600,000 more or less, according to the method of computation used, is claimed as a direct result of the lower rates obtained by the construction of the city plant.

Very properly the city would not reduce its rates below a figure at which the income would meet the demands of the outgo, and the citizens generally were sufficiently mindful of these facts to support the municipal plant notwithstanding the lower rates offered by the private plant. However, the city went to the legislature with the plea that the purpose of the company was to run the city plant out of business, paying any necessary deficiencies in the operation of the Pasadena plant from the profits on its plants in other cities. The legislature saw the point and passed a law preventing a corporation from selling any commodity at a lower price in one community than in another when done for the purpose of exterminating a competitor. Rather than reduce its rates in other cities to the Pasadena rate (consideration being given to the difference in cost of service in the various communities) the company has raised its rates and now has the same schedule used by the city.

This has resulted in a material increase in the number of customers of the municipal plant, the addition of new consumers from July 1 to October 1 being 423, which is 70 per cent. of the total increase for the last fiscal year, ending July 1. The reduction in rate for power purposes made last year has helped and the income has increased largely. Reports for July and August, 1913, show the first results of the removal of the only obstacle to progress and indicate that the public will soon reap the benefit and may soon have their rates reduced to or below those by means of which the private company attempted to throttle the municipal plant. It is the fixed policy of the management to reduce rates to the lowest figure compatible with safe, conservative management.

Notwithstanding the increase in busi-

ness, the cost of operation in August was less than in July, so that the surplus is being added to from both directions.

The effect of larger business upon the unit cost of current is shown by such figures as the following for August, 1912, and August, 1913:

	August, 1912.	August, 1913.
Number of meters	4,207	4,977
Output, k.w.-hr.	238,600	550,100
Manufacturing cost, cents per k.w.-hr	1.006	0.696
Dsitribution cost, cents per k.w.-hr	1.024	0.596
Total operating cost, cents per k.w.-hr	2.030	1.292
Interest and depreciation, per k.w.-hr		0.753
Total cost per k.w.-hr		2.045

If the cost is computed on the amount of current sold it will be about one-third larger for each item and the total cost of current sold in August, 1913, becomes 2.734 cents per k.w.-hr. The corresponding figure for the month of August, 1912, is not at hand, but for the year ending July 1, 1913, the total cost of current sold was 3.656 cents per k.w.-hr. The receipts for August, 1913, were 3.021 cents and for the year ending July 1, 1913, were 4.402 cents per k.w.-hr., so that the reduction in cost to the consumer has been greater than the reduction in cost of current sold to him. This is doubtless due to the larger use of current for power purposes, which brings down the average receipts per k.w.-hr. from consumers, even without taking account of the reduction in rates for power.

The unfair attacks made upon this plant have had one excellent result. They have induced a thoro study of the subject of proper accounting and have brought out the fullest reports of the operation of the plant, thus presenting it as a model in this respect and showing what can be done in a municipal plant under competent financial and technical management.

Cook County, Illinois, Roads

Cook county, Illinois, has started on a hard-road construction era by letting a contract for 4,240 feet of concrete road on an extension of Church street, between Evanston and Niles Center, a road which carries a heavy truck-garden traffic and provides an outlet for automobilists starting on trips to the northwest of Chicago and Evanston. The township, county and the Evanston Commercial Club share the expense equally.

The road will be 16 feet wide, 6 inches thick at the sides and 8 inches in the center, laid on a flat, rolled sub-grade. The concrete is to be made of a 1:2:3 mixture with washed sand and washed ¼ to 1½-inch gravel. Shoulders, 4 feet wide, are to be of crushed rock or gravel. M. Foley & Company, of Evanston, the low bidders, have contracted to complete the road by November 1, including all grading, for $2.83 per lineal foot of road, which is equivalent to $1.59 per square yard.

The routes selected for improvement by the Cook County Board of Commissioners are as follows, all starting at the city limits: Milwaukee avenue to the county line; Twelfth street to the county line passing thru Hillside; Halsted street to Chicago Heights; Western avenue to Homewood; Archer road to Lockport via Summit.

It is the present plan to make the roads 20 feet wide instead of 16, as is the average in Wayne county.

Advantages of the Outside Installation of Water Meters.

The Editor of MUNICIPAL ENGINEERING:

Sir—How many waterworks engineers realize the cost some customs entail? A vast amount of time, money and energy are consumed annually thru the pursuit of unnecessary and unprofitable customs.

It would be difficult to find an almost universal custom more costly in effect or which is responsible for creating more unsatisfactory conditions than the custom of winter water waste. Many years ago, before the advent of the water meter, it was a practice to open faucets and allow them to remain so as long as there was any danger from freezing during the winter months. The idea of protecting the plumbing from frost was seldom regarded seriously by the consumer, for the reason that to accomplish this would cost money; whereas, faucets could be opened and an unlimited quantity of water wasted without any charge. Thus, thruout the country, this practice prevailed, and the wasting of water during winter months was simply stupendous, compared to the quantity that was used for legitimate purposes. The serious and

often desperate condition in which many communities each winter found themselves demanded that some economical and permanent remedy be instituted, which would be the means of preventing both the water from freezing in the services and at the same time eliminate the enormous waste of water. Both waterworks and consumers suffer acutely from this practice of winter water waste. In many localities it was found impossible to maintain adequate pressure for fire-fighting purposes. On account of the tremendous consumption, waterworks are often taxed in winter months to their utmost capacity.

The universal water meter system represents the modern, up-to-date method of causing plumbing to be protected during the winter, and eliminating consumer water waste. Thruout the country it has superseded all other preventive measures, if such they may be called.

Wherever the water meter system is thoroly investigated and its far-reaching benefits are understood, it is invariably adopted. Wherever meters are in use, the plumbing will usually be found to be in sound condition, and protected from freezing during the winter months. The custom of allowing water to run constantly in order to protect the plumbing from freezing, has proven to be an expensive habit and is therefore no longer a custom. Now attention is directed toward the proper outside housing of the meter itself in order to prevent freezing and consequent expense, as well as to insure its constant accessibility to the inspector, at the same time eliminating all expense accruing from tampering.

The more efficient and modern the plant and meter equipment of a waterworks the more economically it should be operated. Superior equipment is only the first adjunct of a successful plant. Administration will decide whether the plant will prove profitable or otherwise. The reasons why so many waterworks plants show a yearly loss can be traced to high cost of meter maintenance, due to freezing caused by insufficient and improper housing of meters, as well as to insufficient rates, unlimited quantities of water furnished certain institutions, etc. It seems evident that many waterworks companies are not fair to themselves, not only in the enormous amount of water waste revealed by the high daily per capita consumption in the standard of meters installed, etc., but in measures adopted to protect their investment in the meters themselves.

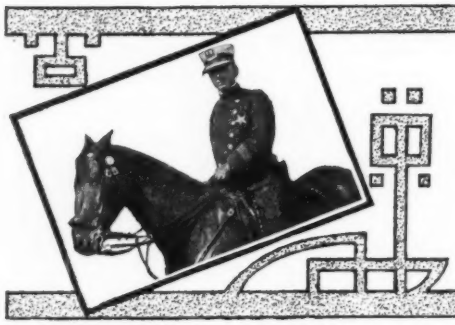
While it is logical to infer that a water meter embracing durability and accuracy in the highest degree would also possess a low cost of maintenance, it may prove interesting to note that a large proportion of the best meters are subjected to high maintenance costs occasioned by damages incurred thru frost. There is no article connected with the equipment of a modern waterworks which is more vital to its success than the water meter, yet this article is constantly subjected to unfair treatment and abuse unless proper protective measures are taken by the waterworks company. Proper outside housing eliminates all troubles occasioned by such tampering as well as the consequent cost of repairs. Outside housing also has its advantages in saving of needless inspection expense. It is not always that some member of the family is at home to the inspector, and we have frequently known of instances where consumers have dumped a load of coal on a meter, so as to prevent the department from reading the dial.

In this connection our experience as to results secured in the outside housing of meters may prove of interest, as in view of the fact that approximately 300 of our meters, inside installations, froze during the past two winters, we favor the outside installation of meters wherever possible. We now have about 100 20-in. meter boxes installed for outside housing ⅝, ¾ and 1-in. meters.

In March, 1912, about 200 of our meters, inside installations, froze. On the same date we made an examination of a ⅝-in. meter, installed in an outside housing, and found that the temperature inside the box registered 40 degrees, while the temperature outside the box was considerably below zero. These meter boxes, which are owned by the company, were furnished by the H. W. Clark Company, of Mattoon, Ill., and are installed complete at about $5.00. To date, we have not purchased forms for the making of concrete bodies ourselves, although this crete bodies ourselves, although this process lessens the cost. The meters are installed 18 inches below the surface and 2½ feet above the frost line, the bottom of the box extending to about the frost line. Our experience has been that the partial burying of the cover with paving or other material, combined with the dead air space and radiating surface of warm earth at bottom of box, insures absolute protection of the meter from frost damage. We have only experienced one case of freezing of meters so installed and investigation clearly showed that above directions as to setting of meter in box had not been closely followed.

Meters so installed are always accessible for repairs and reading. All meddling and tampering on part of consumer is not only eliminated, but considerable money is saved in inspection.

THOMAS E. IRWIN,
Supt. Waterworks Co.,
Huntington, L. I.



LEGAL DECISIONS

Decisions of the Higher Courts of Interest to Municipalities

Repavement — Removing Posts and Hydrants. Where a street has been paved for a part of its width, subsequent pavement of those parts which have never been paved is not a "repavement," as affecting liability for the expense of an improvement. A street paving assessment properly includes items of cost for removing lamp posts and hydrants. People ex rel. Keller et al. v. City of Buffalo, 137 N. Y. Supp. 464.

Injuries to Persons on Streets—Notice of Defect—A municipality is not an insurer of pedestrians against injuries from defective streets, and is not liable for such injuries in the absence of actual or constructive notice; and hence a municipality is not liable for injuries caused by a broken flagstone over a culvert, where the break was a fresh one, and the stone in its original condition was a sufficient protection. City of Corbin (Ky.) v. Benton 152 S. W. R. 241.

Invalid Contract for Fire Apparatus—City Liable for Rent—Const. art. 11, sec. 5, provides that no debt shall be created by any city unless at the time provision is made to assess annually a sufficient sum to pay the interest thereon and to create a sinking fund of at least 2 per cent. Held that, where a contract for fire apparatus was made without complying with such provision, it was void, and the seller was entitled to recover the apparatus so sold from the city. The city's use of the property so purchased raised an implied promise to pay the reasonable rental value thereof and rendered the city liable for rent, which, being an ordinary debt, payable out of current revenues, was not within such constitutional provision. Fabric Fire Hose Co. v. City of Teague (Tex.) 152 S. W. R. 506.

Right of Milwaukee to Build Street Lighting Plant Affirmed—The use of the proceeds of a bond issue authorized by the voters of a city for the purpose of erecting and maintaining an electric light plant to install machinery at the city's refuse incinerator plant for the purpose of utilizing surplus steam which would otherwise be wasted, and using so much of the power generated as is not necessary for lighting purposes to operate the city's flushing station, the value of such power to be charged to the sewerage fund and credited to the lighting fund, is not an unlawful diversion thereof. Since St. 1898, section 926—11, expressly authorizes cities to light streets, public buildings, and grounds, they necessarily may use the streets for the accomplishment of such purpose. A city which prior to the passage of Public Utility Act (Laws 1907, c. 499) issued and sold bonds for the erection and maintenance of an electric lighting plant and bought a site for that purpose, could construct its plant and use the streets for distributing the electricity generated by its plant without obtaining from the Railroad Commission under that act a certificate of convenience and necessity, especially in view of the provision of St. 1898, sec. 1797m74, subsec. 4, that nothing in that act should prevent the construction of a municipal plant, where the existing public utility was operated without an indeterminate permit. Neacy v. City of Milwaukee (Wis.) 139 N. W. R. 409.

Liability of public water supply company for damage by fire.—A public water company is not liable to an individual for loss by fire resulting from an insufficient supply of water at insufficient pressure at fire hydrants to extinguish a fire, unless there be a contract between the parties for a sufficient supply at sufficient pressure. There is disclosed no contractual relation between the plaintiff and defendant, and therein this cause differs from Middlesex Water Company v. Knappman Whiting Co., 64 N. J. Law 240, 45 Atl. 692, 49 L. R. A. 572, 81 Am. St. Rep. 467, where a company incorporated to supply water entered into a contract to furnish water to the owner of a factory with pressure sufficient for fire purposes, which factory was destroyed by fire by reason of the failure of the company to perform its agreement, and it was held that the com-

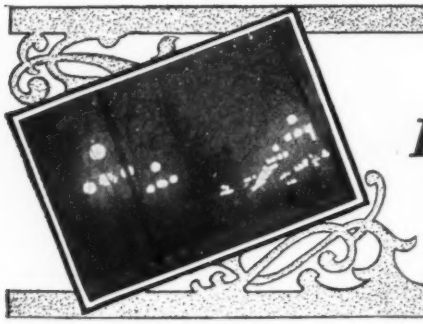
pany was liable for the damages sustained. The case at bar is more like the recent one in this court of Hall v. Passaic Water Co., (Sup.) 85 Atl. 349. In that case a water company was sought to be held liable for damages resulting to a mill through fire under a contract alleged to have been made between the owner of the factory and the superintendent of the water company for a supply of water of a certain pressure at the various openings of standpipes and water pipes in the factory. The testimony failed to establish the making of the contract sued on, and the court held that the defendant company was not liable.—Baum v. Somerville Water Co., (N. J.) 87 Atl. 140.

Assessment for sewer on property adjacent to abutting property.—Code, section 810, requiring the preliminary resolution necessary for construction of a sewer to designate "what" adjacent property is proposed to be assessed therefor, is satisfied by the resolution providing for assessment of abutting and "adjacent property," where the general sewer ordinance defines "adjacent property" as such property not abutting on the sewer, and not otherwise assessed for its cost, as shall lie within 150 feet of it and can be connected with it and use it.—Dunker v. City of Des Moines, (Ia.) 142 N. W. 207.

Items to be considered in assessing water company for taxation.—In the assessment of a special franchise there is no hard and fast rule by which assessors are bound in fixing the value, and, while in some cases the net earnings rule is a convenient and fair way of determining value, in other cases it would not be. In reviewing the action of the tax board in making an assessment, the presumption is that in some way the board has arrived at a fair result, and the burden is on the party claiming to be aggrieved to satisfy the court that the assessment is unjust; and whether the board acted upon sufficient data or not is immaterial if the result is just. In valuing the property of a water company by the net earnings rule, the physical property both in and out of the street, including pumps, engines and pipes employed in performing a contract with the city, is to be accorded a fair return upon its value before any value is attributed to the intangible part of the special franchise. In fixing the value of the franchise of a water company, the board of tax commissioners was not confined to its earnings prior to the assessment, but might consider its receipts under a contract, by which, prior to the date of assessment, the company began to furnish water to a city, altho compensation therefor was not then due, but was received during the year, and to determine how much of the amount received was actual profits. Under the law creating the board of tax commissioners, the duty of the board as to the business of a water company is solely to determine the value of its property as a going concern. Lands purchased by a water company from time to time, aggregating 435 acres valued at $347,000, acquired in good faith under the advice of its engineers and to secure a proper drainage area which would place its supply beyond liability of a failure, prevent others from interfering with it, and provide for the probable future needs of the company, should be allowed as a part of the value of its physical property in determining the return to be received therefrom. Expenses of a water company for the protection of its water supply and to keep its land from becoming unsightly and detrimental to its interest should be allowed in assessment as an expense of its business. In determining the net profits of a water company for the year 1904 as a basis of assessment for the succeeding year, taxes levied for that year were not to be disallowed because not then paid. In determining the reproduction cost of laying the pipes of a water company in streets paved after the pipes were laid, the cost of relaying the pavement was allowable as a part of the reproduction value, the fact that it cost the company nothing being immaterial; and the cost of engineering and supervision was also an item necessary for consideration.—State ex rel Queen County Water Co. v. State Board of Tax Comrs., (N. Y.) 142 N. Y. Supp. 180.

Limit of time to bring suit to enjoin sewer contract.—Cities and Towns Act (Burns' Ann. St. 1908, section 8959), section 265, prohibiting a suit by a property owner to enjoin the construction of any improvement, unless brought within ten days from the letting of the contract, would apply to a suit to have a contract for constructing a sewer declared void and all records affecting title to plaintiff's land canceled and the cloud upon title resulting therefrom removed, so that such suit could not be maintained unless brought within ten days from the letting of the contract.—Anheier et al. v. Fowler et al., (Ind.) 102 N. E. 108.

Insurance company must pay judgment against city for injury due to contractor's negligence.—A judgment against a city employing a contractor to construct sewers in favor of a pedestrian injured by the negligent failure to guard open sewer trenches is binding on the contractor liable over to the city, tho not made a party to the action, but actually defending it, and is on his insurer against loss who, though not a party, employed counsel to defend the action, and the judgment is admissible in an action by the contractor against the insurer to establish the liability of the insurer.—Kibler et al. v. Maryland Casualty Co., (Wash.) 132 Pac. 878.



FIRE AND WATER

The Water Supply of Troy, N. Y.

During the summer of 1913 a high rate of water consumption in the city of Troy, N. Y., following a protracted period of exceedingly dry weather, resulted in an extreme lowering of the water level in most of the reservoirs connected with the system. There was sufficient supply in the Tomhannock reservoir thruout the period, but the Quackenkill was only sufficient to supply the high service, so that it was necessary to depend almost entirely upon the Tomhannock system to supply the low service and to prevent a total emptying of the Upper Oakwood reservoir, which feeds the middle service. This required the operation of various gate valves and somewhat reduced the total amount obtainable thru the Tomhannock conduit, the capacity of which was less than the normal consumption demands; it therefore was necessary from June 10 to November 23 to curtail consumption by reducing the pressure.

The engineers of the National Board of Fire Underwriters have made an investigation of the conditions and in a report dated December 6, 1913, detail the facts and make certain recommendations.

Under normal conditions, the average day pressure at a gage in the water bureau office, at elevation 47, is 42 pounds, with 52 pounds at night. From the commencement of reducing the consumption, the average on this gage was 35 pounds during the day and 29 pounds at night; for short periods of time the night pressures were frequently drawn down to 20 pounds and in a few instances as low as 14 to 18 pounds. Charts from gage at elevation 36, in No. 3 fire engine house, give pressures averaging about 2 pounds greater than those recorded in the Water Bureau office, but the pressure curves in the two cases are strikingly similar.

This reduction of pressure affected sprinkler supply, especially to those plants without tanks. Men were kept on duty at the various gate houses to open the valves in case of fire. This, with the other arrangements made, was sufficient to ensure fire flow for serious fires, but as the storage in the Oakwood reservoir was reduced at times to about 13,000,000 gallons, conditions would have been very serious in case of an accident to the Tomhannock conduit. Conditions similar to this may be expected during any long-continued dry spell, unless steps are taken to increase the supply from Tomhannock watershed.

The city council has authorized by ordinance the laying of an additional conduit from Tomhannock reservoir. Upon completion of the surveys at present under way, pipe will be purchased for delivery during the coming winter, so that the laying may be commenced early in the spring. A section on the city end at least 3 miles in lingth will undoubtedly be finished before the beginning of the next dry season. Several plans are being considered. The one that will probably be adopted is for a single 30-inch line, provided with the necessary valves and specials for a complete duplication at some future date, preferably in a separate trench.

This additional conduit fulfills, in the main, the recommendation made in 1912. Other improvements have been as follows: Excellent maps and nearly all important records are now properly filed in duplicate. A storm-water conduit is being built, to care for flood conditions on the Piscawan kill. Installation of measuring devices on the supply lines and the equipping of services with meters are authorized or strongly favored, but will not be carried out until more important work is completed. Recording gages have been installed. The combining of the two upper services is not considered feasible at this time, but after completing the Martin-Dunham reservoir, will likely be acted on favorably. It is probable in the near future that demands for water on elevations practically level with, or above the Vanderheyden reservoir, will eventually mean a new reservoir at a higher elevation, feeding an extra high service. The use of the Oakwood receiving reservoir as a distributing reservoir for the low service, is strongly advocated by the superintendent, and plans are now being

prepared for a diverting canal around the upper and the low service receiving reservoirs. A new 12-inch extension is contemplated for the near future. Eventually, the Lansingburg supply works will be done away with entirely. Funds are provided for new hose couplings and hydrant nipples, with threads conforming to the National Standard, the contracts for which will be made before January 1, 1914.

Small Town Water Works System

The city of Brawley, Cal., has in operation a very inexpensive water works system. The water, which is obtained from an irrigation canal, is clarified in settling basins and then pumped to a very simply-constructed steel water tower by means of an oil engine.

In the spring of 1911 a depth of 2,000 feet was reached in a well put down by the hydraulic process, which started with an 8-inch casing and ended with a 4-inch casing. The only water struck was found to be brackish; no artesian flow was encountered, nor any strata that would have made pumping feasible.

The plan finally adopted was as follows: Canal water was to be settled in two settling basins of 300,000 gallons capacity each, from which it was to be pumped into a 50,000-gallon steel tank, the bottom of which was 50 feet from the ground. The pumps were direct connected to the mains, and only the surplus over the consumption would flow into the tank. While it had been the intention to erect a larger tank and of greater height, it was found that funds were not sufficient for this purpose.

The system as now constructed covers about one-half square mile of area and comprises two settling basins, a pumping plant, an elevated steel tank and the distributing system. The settling basins, located three-quarters of a mile from the center of population, are 80 by 150 feet, 5 feet deep, with flat slopes. They are intended to be operated in alternation and cleaned by scraping after drying for several days in the sun. They are connected by a system of vitrified pipes with the pumping sumps. Water is settled for twenty-four hours before being used. Their cost was approximately $1,500.

The pumping plant consists of two units, one being a 20-h.p. distillate engine, belted to a No. 4 centrifugal pump of the United Iron Works of Oakland, with a capacity of 500 gallons per minute, 75-ft. head; the second unit, a 40-h.p. Westinghouse electric motor, direct connected to a 2-step, 4-inch centrifugal pump with a capacity of 500 gallons per minute against 160-ft. head, sufficient for two fire streams. The first unit is used for the pumping of domestic supply, the second unit as a fire pump, pumping directly into the mains with the tank shut off. In order to increase the fire pressure, an arrangement has been provided whereby pump No. 1 may discharge into pump No. 2, thus delivering a combined theoretical head of approximately 230 feet. This pressure was utilized for testing the distributing system. The general arrangement and operation of the fire pump were made as simple as possible, so as to enable members of the volunteer fire department to operate the pump in the absence of the mechanic.

The cost of machinery was $4,150. This amount may appear high, but it is to be considered that the whole water works system was let on one contract, and the figures at which the contractor was paid for various items may not in every instance represent cost plus an equal percentage of profit.

The pump house is a substantial timber building with galvanized sheet iron walls and roofing. The roof trusses were designed for being used in mounting and dismounting machinery. The building is well ventilated, screened and painted, and was let for the sum of $1,889.

The steel tower and tank are of the hemispherical bottom type, using a 4-post tower, which style of structure is now being used almost exclusively for water storage purposes. This tower and tank were built in accordance with the standard plans and specifications of the Des Moines Bridge and Iron Company. The capacity of the tank is 50,000 gallons, the diameter being 18 feet and the height of the cylinder 24 ft. 4 in. The tank shell is made of ¼-in. plates thruout, except the lower ring of cylinder, which is 5/16-in. The supporting tower is 50 feet to balcony line and consists of four columns, being in two sections. The columns are made of 10-in., 15-lb. channels, latticed, and the struts are made of four angles 2½ by 2 by ¼-in. The bracing rods are 1-in. rounds thruout. On account of variations in temperature existing at Brawley, special provision was made to take care of the difference in expansion and contraction of the riser pipe and the water tower columns. The cost of the tower was approximately $3,900 complete, including foundations. This cost is considerably higher than usual, on account of the very high cost of foundation materials and transportation charges.

A Novel Method of Sterilization of London's Water Supply.

From Our London Correspondent.

The insuring of an adequate and pure water supply for London is a subject which must always be of importance. The supply is drawn from the Thames

and the Lea, both of which rivers run thru populous districts where artificial contamination is very liable to occur. There are, of course, stringent regulations forbidding the discharge of impurities into the river, whether manufacturing or otherwise. But regulations can often only be effective in enforcing punishment after an offense, when the damage has been done.

The experience of the Metropolitan Water Board has shown that even highly impure water is purified from bacteria by storage over a sufficient period of time, but coloring and oxidizable matter are not destroyed thereby. The best conditions, if the water is to be cured by storage, would be for those in charge of the pumping plant to have absolute discretion to take the water at the bacteriologically best time, and to have sufficient storage capacity to hold this water for a very considerable period before use. In order to store sufficient water at the best times, pumping plant would be required much in excess of the average demand, which would be idle for a large part of the year. Experience further shows that the water is purest in time of drought, when, however, objection is naturally taken to the abstraction from the rivers of huge quantities of water.

Large increased storage and pumping facilities coupled with the board's unrestricted right of abstraction are liable to arouse alarm as to possible draining of the river in hot seasons. Accordingly in 1911 the board laid before Parliament proposals in the nature of a compromise. They asked for largely increased storage facilities in the form of eight new reservoirs and a new intake. In return they offered to give up their unrestricted right to take water at will. The advantages claimed were that drought was secured against, and that their storage policy would be efficiently developed. The water would be able to stand long enough to insure purity. It was further claimed that the scheme for bringing water from Wales could be dropped, with consequent saving of enormous cost. The bill, however, was severely handled in Parliament. Three reservoirs were granted, three rejected, and two withdrawn, as was the new intake. The unrestricted right of abstraction was annulled, but the concessions asked for in the conditions of abstraction were only partly granted. The principle of a progressive storage scheme was conceded, by which the board is to construct reservoirs in view of an increase of population up to 1941. But the paucity of tangible results and the evident reluctance of Parliament to sanction extensive new works in the future has left the board still face to face with the problem of insuring the purity and continuity of the water supply.

Dr. A. C. Houston, the board's director of water examination, urged for some years that specially impure water should be excluded or else treated in some way before entering the reservoir. Dr. Houston in his eighth research report devotes his attention to a novel inexpensive method he has discovered for purifying the water.

Lime has been used for many years to soften water. Now, hardness is due to two causes. The permanent hardness (relatively small) is due to dissolved sulphates of calcium and magnesium. The temporary hardness (removable by boiling) is due to bicarbonates dissolved, the bicarbonates being formed by combination of carbon-dioxide present in the water with the ordinarily insoluble carbonates. In the Clark water-softening process quicklime or slaked lime is added. The lime at once combines with excess carbon dioxide present, as well as reducing the soluble bicarbonates. The result in both reactions is insoluble carbonate, which is precipitated. Great care is taken in the process to avoid excess of lime being added. Such an eventuality leads to rehardening, and, of course, would give a supply of lime-water instead of pure water.

Dr. Houston has evolved a modification of the process which proves to be a certain method of treating bacilli. He adds one part of quicklime to 5,000 parts of raw (unstored) Thames water. After chemical reactions are completed 0.007 per cent of free lime is left in the water. After a wait of five to twenty-four hours it is found that this excess has killed the B. coli germs present. The 0.007 per cent excess of lime is then neutralized by the addition of not less than 25 per cent of stored water, which is softened by the lime.

Dr. Houston points out the curious fact that for years we have been deliberately avoiding the use of this beneficent quantity of lime. By always adding just less than is necessary to soften the water we have simply produced carbonate of lime, which is insoluble and bacteriologically inert. Whenever, accidentally, an excess of lime has been allowed, a useful bactericidal action has been taking place and it has at once been stopped.

The aim of the experimenter was to use the minimum amount of lime necessary, allowing ample time for action. With a specimen of ordinary Thames water, after one hour 42 out of 43 B. coli were still alive. After five hours 26 out of 43 were dead. After twenty-four hours 42 out of 43 were dead.

Considering only its bactericidal ac-

tion within twenty-four hours, to achieve the above effect, 15 pounds of quicklime should be added to 7,500 gallons of raw water, 2,500 of stored water being afterward added. The cost of lime would be three cents for the 10,000 gallons of pure water thus produced. Reckoning the demand at 200,000,000 gallons daily, the cost of lime to treat three-quarters of the amount drawn from the river would be about $625, or $212,500 per annum.

The added stored water is proved by experience to be quite sterile of disease bacilli. Not more than 75 per cent of the bulk may be treated if the natural alkalinity of the other 25 per cent is to be relied upon to neutralize the 0.007 per cent of lime, but any smaller proportion may be treated with corresponding reduction of lime consumption.

This excess lime process seems to meet all the difficulties mentioned earlier in the article. It is particularly suitable for flood water (which is most abundant, and, unless treated, is most dangerous), for such water is usually less hard and the lime process has a clarifying as well as bactericidal effect. It is claimed that the cost of lime treatment brings a considerable return, even a net profit, by economizing soap and fuel thru softening.

The treatment increases the source of supply in effect by rendering the water always fit to be drawn on. It postpones the construction of new reservoirs, for the lime-treated water direct from the river is bacteriologically as good as adequately stored water. By reducing the strain on the storages it prolongs the possible period of storage. Thus, using the basis of 75 per cent of treated water and 25 per cent water from storages, the period of storage for that 25 per cent would be increased from 30 to 120 days. Or, if the 30 days' storage period is adopted, the existing reservoirs would have much greater capacity, thus postponing the expense of new works to meet the expanding demand. The process is quite innocuous, for it only leaves lime compounds behind which were there before. It would raise the London water supply to an undreamt of level of purity. All epidemic water-borne diseases, such as cholera and typhoid fever, would be absolutely eliminated.

Mortality Rates in Relation to the Water Supply

In a paper before the New England Water Works Association, John A. Vogelson, chief of the Bureau of Health of Philadelphia, outlined the history of water purification and its effects in that city.

Philadelphia was engaged in improving its water supply by construction of filtration plants and re-arranging its water supply distribution system from 1900 to 1911. The typhoid fever rates of such districts as received filtered water in the early development of the improvements began to decline immediately after the introduction of filtered water, and following the completion of the last of the five filtration plants in 1911, the typhoid death rate for the entire city shows a consistent decrease from 72.4 per 100,000 in 1906 to 12.5 per 100,000 in 1912. Isolated sections of the city, notably West Philadelphia, with a population of 267,840, had a typhoid rate of 5.9 per 100,000 in 1912. A large percentage of the typhoid which formerly scourged Philadelphia was undoubtedly water-borne, and the marked reduction of typhoid in this city is a notable sanitary achievement, due in by far the largest part to the filtration of the water supply.

The average total mortality rate for nine years, 1862-70, was 2,291 per 100,000 and consistently declined to an average rate of 1,792 for the decade 1901-10, and still further declined to 1,522 per 100,000 in 1912, the lowest record rate in the history of Philadelphia.

The time elapsed since the entire city water supply has been filtered is too short to give periods for comparison for before and after filtration. A city of 1,600,000 people presents most complex conditions which bear directly on its total mortality rate. Tuberculosis, infant mortality and better housing and sanitation campaigns have been waged before, during and after improving the water supply. The notable reduction in mortality rates occurs in the age period under one year, and dates its downward trend from 1892 with intervening fluctuations. Improved milk supply and the use of diphtheria antitoxin are also strong factors for reducing mortality. They have influenced the changes in Philadelphia. One isolated section of the city shows changes paralleling in the main the changes for the entire city. Another shows marked declines in total mortality and from typhoid fever, tuberculosis of lungs, pneumonia, diarrhoea, enteritis, diphtheria and croup, heart disease and kidney diseases, for which diseases the entire city rates also declined, except in heart disease and kidney diseases. This isolated section was largely influenced by an institutional factor, having within its limits many hospitals, asylums, houses for aged, etc.

The improved water supply undoubtedly was by far the largest factor in reducing typhoid fever, and it will also prove of great hygienic value and be of benefit in reducing total mortality, other than thru the typhoid component, in what ratio the future will decide, if it can be determined.

From the minority report on the proposed Jerome Park filters for the New

York city water supply, on which the postponement of the filtration of the Croton water supply was based, the following figures are taken, showing the effect of methods of water treatment upon the typhoid fever death rates in various cities of the country.

The notations in the table are explained as follows:

M. Mechanical filtration.

S. Slow sand filtration.

P. Preliminary filtration.

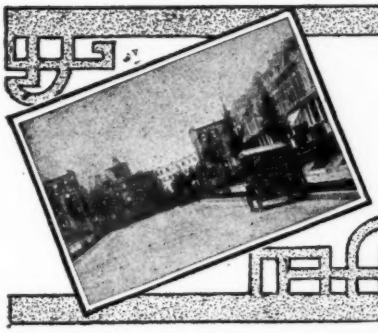
H. Hypochlorite used.

*Marks date of installation of water purification system; purification plants installed prior to dates in table not so marked.

† Changes made in source of water supply.

TABLE SHOWING EFFECT OF WATER PURIFICATION ON TYPHOID FEVER DEATH RATE PER 100,000 POPULATION.

City.	1900-05.	1906.	1907.	1908.	1909.	1910.	1911.	1912.
Birmingham, Ala., M.....	....	....	....	....	59.7	51.3	43.4	....
Oakland, Cal., M.....	....	....	....	....	8.2	14.0	12.1	....
New Haven, Conn., S.....	....	....	....	....	20.3	18.0	23.5	....
Washington, D. C., S.....	....	....	....	....	36.0	24.5	20.9	....
Atlanta, Ga., M.....	....	....	....	....	58.1	42.6	56.3	....
Indianapolis, Ind., S. P...	....	....	....	....	19.4	28.7	26.2	....
Louisville, Ky., M.....	....	(58	average.		)	*30.8	22.0	18.0
New Orleans, La., M.....	....	....	....	....	29.3	31.6	30.7	....
Paterson, N. J., M. H.....	....	....	....	....	5.1	6.4	6.2	4.6
Albany, N. Y., S. P. H....	*24.8	20.3	20.0	10.9	18.8	14.9	17.8	17.8
(Hypochlorite treatment at intervals added in 1910.)								
Amsterdam, N. Y.....	22.2	24.8	15.9	0.0	11.9	†22.1	9.0	11.6
Auburn, N. Y.....	23.8	12.1	6.0	46.6	17.5	8.6	7.9	11.2
Binghamton, N. Y., M....	*25.6	9.1	18.2	15.2	13.1	12.4	4.0	17.8
Cohoes, N. Y., M.....	92.9	57.8	78.2	62.0	82.2	86.8	*108.5	48.0
Elmira, N. Y., H.....	45.5	44.7	28.0	30.7	33.5	26.9	*13.3	15.9
Lockport, N. Y.....	47.8	†67.6	50.1	60.7	49.7	†11.1	22.0	16.6
Middletown, N. Y., M. H..	*24.1	18.8	18.8	42.1	18.1	26.1	59.1	H26.5
(Hypochlorite treatment added in 1912.)								
New York City.....	18.6	15.5	17.4	12.8	12.7	11.6	11.0	9.7
Manhattan, H.....	....	....	....	....	11.3	*11.5	10.7	7.9
Bronx	....	....	....	....	19.2	*9.5	8.1	5.2
Average of two.....	....	....	....	....	12.3	11.2	10.3	7.4
Niagara Falls, N. Y., M. H.	141.5	154.5	126.0	87.1	74.9	97.9	187.0	*71.5
Ogdensburg, N. Y., M....	52.8	67.3	47.1	26.8	26.8	37.5	30.8	*36.7
Oswego, N. Y.....	47.5	58.0	66.0	62.2	26.6	†51.2	12.7	21.0
(Hypochlorite treatment added in 1910.)								
Peekskill, N. Y., M.....	22.5	15.2	14.0	202.3	12.9	*26.2	19.0	0.0
Poughkeepsie, N. Y., S. H.	*42.4	39.4	112.0	34.5	23.0	H17.8	14.0	13.7
(Hypochlorite treatment added in 1910.)								
Rensselaer, N. Y., M.....	*67.5	18.6	58.3	30.0	29.9	28.0	H18.7	9.4
(Hypochlorite treatment added in 1911.)								
Rome, N. Y.....	21.6	28.1	17.0	26.4	16.0	19.3	9.4	22.9
Cincinnati, O., M. H.....	....	....	....	....	13.2	5.8	11.3	....
Cleveland, O.....	....	....	....	....	13.0	18.7	14.7	5.8
Columbus, O., M. H.....	....	....	....	....	21.3	16.5	13.8	....
Toledo, O., M.....	....	....	....	....	29.9	36.2	22.5	....
Philadelphia, Pa., S. P...	....	....	....	....	21.8	17.5	14.1	12.5
Pittsburg, Pa., S. H.....	....	....	....	....	13.0	13.1	14.1	....
Providence, R. I., M.....	....	....	....	....	11.5	17.4	11.7	....



ROADS AND PAVEMENTS

Concrete Trolley Poles in Cleveland

In certain sections of Cleveland, Ohio, a city ordinance prohibited further erection of wood poles and required also that all poles be removed within two years and wires placed below ground. There were already about 50 octagonal concrete poles in service in the city and these had attracted so much favorable comment because of their uniform drab color and straight lines, that the company obtained permission to leave wires above ground providing concrete poles were installed.

After two years of use, there are now 750 concrete poles in service largely replacing wood poles in outlying districts and being used in practically all new work.

The standard concrete pole is 28 feet long, 11 inches in diameter at the butt and 6 inches at the top, and is octagonal in shape starting 6 feet from the square butt. The weight is 1,700 pounds and when set 6 feet in the ground withstands 500 pounds pull at the top. The cost of manufacture is $12.00. Porcelain insulators safe for 6,000 volts are used in order that no electrolysis effects may occur.

The reinforcement consists of eight ⅝-inch square twisted bars placed so that the center line of the steel is 1 inch from the concrete surface. A very rich and wet mixture is used and the aggregate is proportioned for maximum density, being tested frequently during construction. The poles are kept continually and uniformly wet thru a period of 28 days.

The forms consist of two steel channels pressed from heavy sheets with a varying width, which are held by eight U-shaped rods passing thru the flanges. The forms rest on a wood pallet and wood strips are inserted to obtain the bevelled edges. The upper surface is trowelled smooth.

The poles are superior in every way to wood poles, are cheaper than tubular steel poles, require little or no maintenance and are received favorably by the public. Their use is now standard practice in Cleveland.

Street Maintenance in Chattanooga, Tenn.

The city of Chattanooga, Tenn., is governed by a commission of five elected members. The latest number of *Municipal Record*, which gives periodical inforamtion concerning the city government, is devoted to the annual reports of the departments. Among these reports is that of A. N. Sloan, the commissioner of streets and sewers, who has charge of construction, maintenance and control of streets, sewers, bridges, viaducts, subways and sidewalks, including savenger service and street cleaning. On his staff are the city engineer, the superintendents of street repair and street cleaning and the chief sewer and sidewalk inspectors.

Some details regarding street cleaning, effect of automobiles on streets and automobiles in the department are of general interest. Concerning these Mr. Sloan has the following to stay, in part:

During the year we dispensed with the old method of street sweeping, and instead washed the streets, which has been much more satisfactory, and has practically abrogated complaint from our citizenship as to dirty streets. In fact, a complaint coming to the department in this regard is almost unknown.

The increase in automobile travel has been so marked that a better grade of streets is demanded than ever before. The complaints that come to the department are almost entirely from those who drive machines. A street that is sufficiently smooth for ordinary wagon or buggy travel is often considered very bad for automobile traffic. The low wheels and high rate of speed magnify the inequalities in surface as compared with other traffic. In this connection, permit me to say that we find it impossible to keep chert streets where there is much automobile traffic in anything like good condition. Nothing will withstand the suction created by rubber tires save a bituminous-filled or brick street. We are experimenting with one block of chert street where we have used a preparation that appears to cement the street so as to better withstand the auto-

mobile traffic. We may during the year find it expedient to treat some other streets in the same manner, provided we can be as fortunate in saving money from other departments that we may expend it on street repairs. I believe that a vehicle tax for the maintenance of roadways ought to be enacted in Tennessee. It is doubtless safe to say that one-half of the automobile owners are not property taxpayers, and there should be some way of making them bear their proportion of the expense of keeping up roadways.

During the year we did not buy any wagons, having built in our shops all the additional wagons used. We find them better adapted to our purposes, and they will outwear any wagon bought from dealers; besides, the character of wagon built is obtained much cheaper, as the shop force puts in all its extra time on this work. The saving to the department from the shop alone has had more to do with the surplus that we used on street repair work than any other one cause. The rolling stock is kept in good shape and in commission all the time. This was impossible under the old system of sending the wagons to outside shops for even the slight repairs. All wagons are examined after each day's work, and any repairs needed are made before the hour of starting them out the following morning. So it is with the shoeing of stock. In our opinion the blacksmith and repair shop has increased the efficiency of the scavenger department 20 per cent.

During the year we found it necessary to buy one additional automobile, for the street superintendent. The increase in his work on account of the extension of the corporate limits of the city, and the vast amount of work being done in that territory in the installation of a sewer system, made it necessary that he have some quicker means of transportation, or that he be given an assistant. His horse and buggy both being worn out, we bought a Ford runabout for $420, which was not much more than a new horse and buggy; besides it enables him to do three times the work that he could have done with a horse and buggy. In this conection, I beg to state that the automobile equipment of this department, which consists of four machines, has not only enabled us to give better service, but the saving made by the large truck alone is more than the entire up-keep of all the equipage for the entire year. By actual figures that truck has saved $1,200 above what it would have cost to do the work with wagons and teams. The total outlay for up-keep for all machines was $992.10. Without figuring the additional work secured through the other three machines, and the more perfect supervision, which means the saving of money, we consider this showing most creditable. I know there is a disposition with those not acquainted with the facts to criticize any department of the city that spends money for automobile machinery. If one of our leading merchants or factories dispenses with wagons and teams and buys gasoline trucks and automobiles he is called "progressive," but if a commissioner of the city, using the same intelligence in the conduct of the city business, finds it economical to make the change, how quick the criticizing tongues begin to wag. If anyone questions the figures presented as to the total up-keep of all four of the machines, and the fact that the saving on the truck alone more than pays for the upkeep of all, I would be glad to have him examine the records in the office. I admit that automobile machinery is often expensive, but my personal experience is that it is usually caused by inefficient or careless handling. All machinery of this character in the department is examined daily and kept in first class repair. If a driver is detected carelessly operating a car, he is dismissed. This has happened twice during the past year.

Of the one hundred thousand dollars set apart for the use of this department for the last fiscal year there was returned to the general fund $89.98 after all bills contracted during the year had been paid. Whatever is given to this department will be expended to the best advantage possible, but not one cent will the department over-draw the budget allowed. If more work is expected, a larger appropriation must necessarily follow. The commissioner has no legal or moral right to exceed the budget apportioned to his department. Besides this balance of $89.98 there was collected and turned over to the general fund $1,709.35, for the sale of manure and other refuse.

Stone-Gravel Road Costs

By K. I. Sawyer, County Road Engineer, Menominee County, Michigan.

The following information is founded on experiences encountered in the construction of the Bay Shore Road. The southerly seven miles is thru a considerable settlement. In the summer time, it is subjected mainly to a pleasure traffic, but in the fall it must stand heavy and continuous teaming. A load of 60 packages of fish on a common 3½-inch tire wagon is not unusual; this would weigh about 5 tons. This southern seven miles of road was built as one job.

The main construction crew was equipped with a No. 3 Austin gyratory crusher and appurtenances, two Port Huron traction and hauling engines, one Port Huron roller, ten Port Huron trac-

tion and hauling engines, one tank wagon, road machines, etc.

A synopsis of the specifications under which the road was built is as follows: Road ditched 24 or 30 feet between ditches, depending on depth of ditches and of sand; subgrade of native sand; 3-inch layer of crusher screenings (clay loam and pebbles) laid on a sub-grade worked into sand clay bed and rolled when dry with 12-ton roller; 5 inches by 12 feet clear crushed stone slightly bound and rolled; then 4 inches by 18 feet clear crushed stone bound with little excess of screenings rolled dry, in puddle, and then dry; repeat as necessary.

wagon from the bin. The engines handled two to four wagons to a train according to climatic conditions. The usual practice, however, was to haul three wagons for the good of the road.

Owing to the fact that the steam haulers were a new part of the county plant the last season, a comparison was worked out to show the advantage of using this equipment. This comparison was taken directly from the schedule of actual costs of the road. In the work 1,277 cubic yards of stone were handled by the engines and 1,912 cubic yards by teams. This work was under identical conditions and gives a good basis of comparison. The team haul rate was 53

Cost of Hauling With Tractor and Teams

Steam Haul.

	Labor	Coal, Oil, Etc.	Cost	Av. haul Ft.	Max. haul Ft.	Yds.	Av. Cost 1 yd. Cts.	Rate 1 yd. mi. Cts.
May	$ 16.62	$ 9.16	$ 25.78	Instructing crews				
June	63.65	110.04	173.69	2,300	4,600	1,359	12.7	34.2
July	185.25	139.20	324.51	6,500	10,200	2,826	11.5	9.4
August	257.26	234.30	491.56	13,000	16,100	3,524	13.9	5.7
September	182.14	171.10	353.24	17,800	19,500	1,816	19.0	5.6
October	199.22	123.40	242.62	12,000	19,500	1,860	13.0	5.8
November	36.65	26.88	63.53	2,500	5,100	792	8.7	18.5
Totals and averages	$940.87	$814.08	$1,754.95	9,700	19,500	12,177	14.5	8.6

Team Haul.

	Cost	Mean haul Ft.	Yds.	Av. cost 1 yd. Cts.	Rate 1 yd. mi. Cts.
June	$ 12.00	1,300	42	28.5	74
July	63.88	2,000	168	37.9	97
August	162.85	2,300	710	22.9	53
September	67.30	2,300	328	20.5	48
October	99.75	1,200	614	16.2	72
November	48.48	5,700	50	97.0	91
Totals and averages	$454.26	2,300	1,912	23.2	53

The plant site was wooded when work was started and this increased installation charges considerably. The gravel from the bank was plowed loose, then teamed in wheel scrapers to the crusher the teams driving over the crusher on the feeding platform and dumping the gravel directly into the crusher. Most of the season but two grades were taken by the screen on the bin, but all dirt was removed from the stone by a ⅜-inch dust-screen mounted outside the stone screen. The bins are so built that the engines and cars run under them to receive the contents of two compartments and receive the third from the end. All ports in the bins are on the bottoms which are built horizontal. It took about 3 to 4 minutes to load a 6-yard

cents per yard mile. This would be considered high under normal conditions. The conditions under which the hauling was done were very stern, as is shown by the fact that it was possible to load only about a ton to the load for teams at the start, and even then it was necessary to double the teams over considerable of the road now built. Only good teams weighing 2,900 pounds to 3,400 pounds each were used. The following is a comparison of the costs of the engine haul and the team haul:

Engine Haul.

Engines hauled 12,177 cu. yds. a mean haul of 9,799 ft., as shown in the table, at a cost of $1,754.96

20 per cent. interest and depreciation on $6,200 plant.....	1,260.00
Water tower expenses.....	140.92
Cleaning and repairs on haul equipment	163.26
Material placed in engine track in excess of amount required by specifications, 1,703 cu. yds. at 47 cts.....	800.41
Total	$4,119.55

Team Haul.

Team haul at 53 cts. per mile, shown in table, gives average cost for 9,700 ft. mean haul of 53 cts. multiplied by 9,700 and divided by 5,280 feet per mile, or 96 cts. per cu. yd., and the above 12,177 cu. yds. if hauled by team would have cost 96 times 12,177 or.....	$11,689.92
Economy by use of engine.....	$ 7,507.37

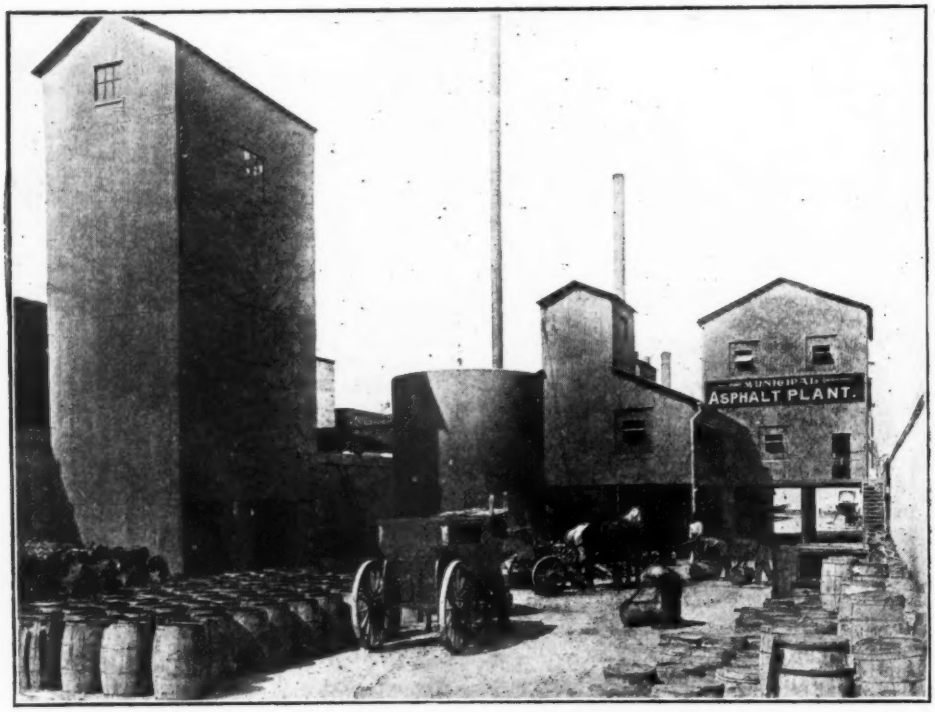
Two rollers were kept at work continually, one on the dump and one most of the time on completed work, rolling the shoulders to prevent movement of the sub-grade. All ditch and sub-grade work was handled by the grade crew under the grade overseer. The major portion of the work of the spreaders was passing the excess screenings out onto the shoulders and shaping them, as after a little practice the spreading cars dropped the material practically in place.

The Chicago Municipal Asphalt Paving Plant

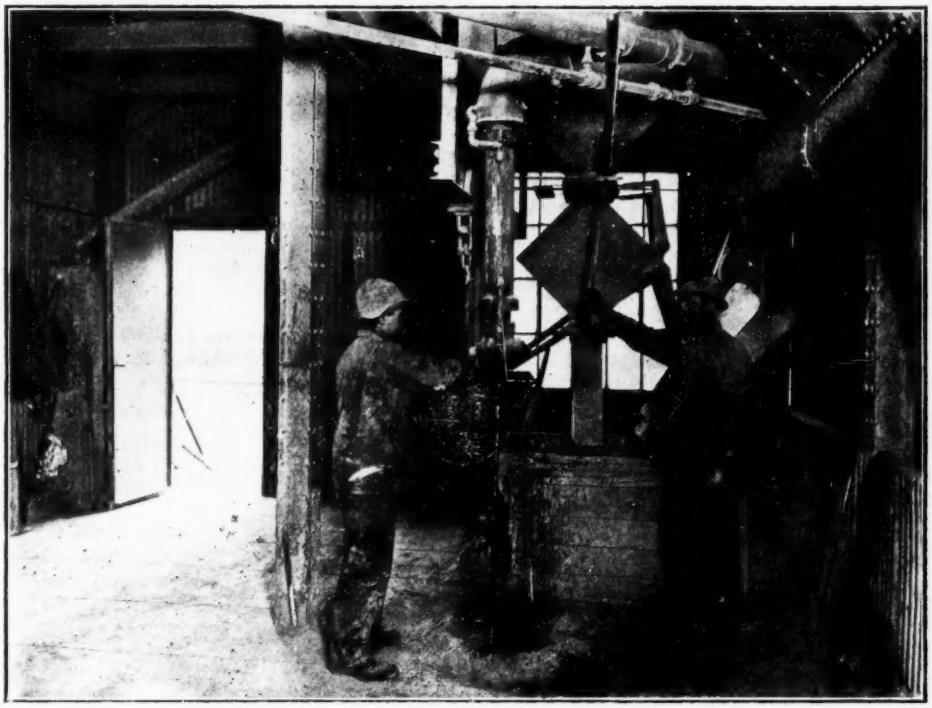
In the midsummer of 1913 there was completed and put into operation for the city of Chicago one of the largest and most complete asphalt paving plants of the United States. This plant was built for the city under contract with Hetherington & Berner, of Indianapolis, and should have been put into practical service earlier in the season but owing to labor conditions in that city, and the delays caused by jurisdictional strife between various trades the completion of the work was unavoidably delayed. The accompanying illustrations show the plant in its finished condition. This plant has a capacity sufficient for the laying of 3,000 square yards of finished asphalt topping per day, 2 inches thick when compressed upon the street, or, as an alternative it will turn out 2,000 square yards of finished work consisting of both binder and topping, in one day.

The principal elements of the plant are as follows:

Four large melting kettles or cauldrons, each having a cubical content of 340



CHICAGO MUNICIPAL ASPHALT PLANT.



INTERIOR *of Chicago's municipal asphalt plant. These two men control the whole mechanical delivery of materials.*

cubic feet. Two of these kettles are fitted for mechanical agitation and two without, for plain melting.

The machinery for the drying and heating of the mineral ingredients consists of one battery of the well known Hetherington double drum sand dryers of the latest improved type, and one single drum dryer. When operating for both binder and topping at the same time the single drum is used for binder material and the double dryer for sand material. When it is desired to work the plant to its entire capacity on topping material alone then both the single and the double dryers may be used for heating sand.

Two standard 9 cubic feet asphalt mixers are installed in the plant and may be operated separately or together as may be desired.

The design of the building is such that there are two driveways for teams, one leading under the binder mixer and one under the topping mixer; thus both binder and topping may be delivered from the plant simultaneously.

In this plant the minimum amount of hand labor is employed. The melted asphaltic material is handled by pneumatic means and the mineral material is handled mechanically from the point in the yard at which it enters the various feeding devices connected with the heating and storing appliances. In the illustration showing the interior of the plant two men are shown at a mixer; these two men alone have control, by mechanical means, of all of the material that enters into the mixer.

In addition to the plant proper and its mechanism, this installation embodies also large storage facilities for fluxing and fuel oils and for crude asphalt.

The plant was especially designed to fit into the only available site that could be provided. This site was made by vacating a street between Ashland and Laflin avenues. This street was bounded at either side by the huge retaining walls of the elevated tracks of two railroads, the Chicago, Milwaukee & St. Paul and the Northwestern. In order that material might be handled from the grade of the tracks down to the grade of the plant yards a large electrically operated platform elevator having a platform 12 feet by 15 feet in size had to be provided. This elevator is inclosed within a steel framed tower which is shown in the foreground of the view of the plant.

The power used for the operation of this plant is entirely electrical. Oil is used as a fuel for the sand heaters and for the melting kettles. Dust collectors

are provided as a protection to the neighborhood from dust and smoke from the plant. The entire plant structure is of fireproof construction, the frames being made of structural steel incased with galvanized corrugated iron. The floors are concrete, smooth finished in granitoid.

The contractors' price for the complete installation of this plant was practically $45,000. In reply to an inquiry of the city official of Chicago who is in charge of this plant as to its capacity and efficiency, a letter has been received from which we quote the following:

"In reply to your communication I take pleasure in advising you that the asphalt plant built for the city of Chicago has stood up to all of its requirements. While we have been unable to run this plant to its full capacity every day, because of the fact that the city of Chicago is only doing its own work on streets out of reserve, on several resurfacing jobs on old brick and granite pavements it has exceeded its capacity. On one resurfacing job we have turned out an average of 250 tons per day for six days. The last day's run was 289 tons.

Very truly yours,
WALTER G. LEININGER,
Superintendent of Streets."

Asphalt Pavements in Buffalo

Some interesting data regarding asphalt streets in Buffalo, the traffic over them and the cost of maintaining them have been derived from the last reports of the department of public works and the latest specifications, with the aid of Geo. H. Norton, deputy engineer commissioner, who has special charge of construction and maintenance.

The changes in traffic conditions with the change of season and the tendency to increase in weight as well as number of vehicles is shown by the following table, made by combining the records of traffic over certain streets taken (1) November 30 to December 18, 1909, (2) June 8 to 22, 1910, and (3) June 4 to July 1, 1912; the figures in each case being the averages per 14-hour day of three consecutive days' observation taken between the time limits stated. These streets are all paved with asphalt.

Location.		Width of Pavement.	Av. daily tonnage per ft. of width (14 hours).	Average tonnage per vehicle.	Average No. of automobiles.
Delaware	(1)		70.16	1.03	1,309
at	(2)	40	90.34	1.14	2,077
Chippewa	(3)		112.93	1.26	2,779
Delaware	(1)		14.96	1.47	127
at	(2)	36	24.16	1.52	284
City Line	(3)		28.42	1.40	504
Main	(1)		55.37	1.03	2,164
at	(2)	58	70.33	1.13	2,247
Tupper	(3)		121.07	1.23	4,451
Main	(1)		32.61	1.01	694
at	(2)	58	50.03	1.20	1,275
Seneca	(3)		67.62	1.18	2,108
Michigan	(1)		50.70	1.14	138
at	(2)	42	57.07	0.96	403
Broadway	(3)		39.93	1.02	282

Remembering that (1) is under winter conditions and (2) and (3) are taken in June and that (2) was taken six months after (1) and (3) was taken two years after (2), the following conclusions can be drawn:

a. That summer traffic is materially heavier than winter traffic.

b. That in every case but one there was a material increase in traffic from 1910 to 1912.

c. That there is a marked tendency to increase in weight of vehicles, tho this does not show at all the points at which census of traffic was taken.

d. That there is a very marked increase in the number of automobiles. In fact, the increase in amount of traffic and in weight of vehicles is due to the increase in number of automobiles, there being a slight tendency toward a reduction in the number of other vehicles in use.

Michigan at Broadway shows differences from the other locations mainly because there was a material reduction in all kinds of traffic at that point, the reason for which is not explained.

All these are important points, where the city traffic is heavy, most of them being in the down-town section.

In September, 1912, between the 3d and 23d, traffic records were made at the points in the following table, where the conditions are the average of the outlying sections of the city:

At Intersection of	Direction of travel.	Width of pavement.	Av. daily tonnage per ft. of width (14 hrs.)	Average tonnage per vehicle.	Av. No. of autos.
Ellicott	South	28	5.54	1.04	63
and Riley	East	28	8.25	1.08	102
Wohlers and	South	28	9.25	1.10	55
Northampton	East	28	5.89	1.05	54
Ashland	South	30	5.57	1.07	65
and Utica	East	32	11.00	1.13	181
Prospect and	South	36	14.22	1.10	203
Pennsylvania	East	32	5.19	1.09	42
South Park	South	40	14.10	1.20	138
and Como	East	28	1.71	.92	11
Dearborn	South	30	5.37	1.06	39
and Austin	East	28	2.43	.94	14

In general the average weight of vehicles is less in these light traffic streets than in the heavy business districts, largely because the proportionate number of automobiles is much less.

Excepting Michigan at Broadway, the number of automobiles is from 1¾ to 3 2/3 times as many as the number of other vehicles at the locations listed in the first table of heavy traffic, while the number of automobiles on the lighter traffic streets is from 24 to 40 per cent., with only one case in which the number of automobiles exceeds the number of other vehicles.

These comparisons may give some idea of the reasons for the variations in cost of asphalt maintenance.

The city of Buffalo has kept the most complete continuous record of the cost of asphalt repairs from the beginning of asphalt paving in the city, and can give the cost of maintenance, repair, resurfacing and reconstruction of any street for any period of its life as an asphalt pavement.

About two-thirds of the area of streets under maintenance by the department are asphalt streets and about 80 per cent. of the maintenance funds are expended on asphalt. About 40 per cent. of the area of asphalt under maintenance is over twenty years old, or is older than the average life of asphalt pavements. Of pavements laid more than twenty years ago, 2,268,837 square yards laid between 1878 and 1892, more than half (1,200,896 square yards) are still in use.

The average age of the asphalt pavements which were laid more than twenty years ago is 20.97 years on streets without car tracks and 18.22 years on streets with car tracks, being 2.75 years in favor of the former. The average age of asphalt pavements replaced during the twenty years from 1892 to 1912 was 17.85 years on streets without car tracks and 16.06 years on streets with them.

The oldest pavement in use is thirty-two years old, and is on a street with car tracks. The average age of pavements maintained by the city, none being less than ten years old, is 19.07 years on streets without car tracks and 16.20 years on streets with car tracks, about half the area being between nineteen and thirty-two years old and half between ten and nineteen years old.

The average cost of repairing asphalt streets, figuring the streets repaired only, has increased from 4.61 cents a square yard, the average for the whole period prior to 1902-3, to 6 cents per square yard for the whole period prior to 1911-12. Figuring the whole area of streets maintained, i. e., more than ten years old, the cost per square yard for maintenance has increased from 2.89 cents per square yard for the period prior to 1902-3 to 3.94 cents per square yard for the whole period prior to 1911-12. These figures are given

in the report to show that the replacement of old pavements is not rapid enough to keep the cost of repair uniform year by year. Whether the economical rate of replacement can be determined is questionable, individual variations being so great. The general rule stated is that repairs should be continued until the sum of the whole cost of repairs and of the renewal of top, divided by the age of the pavement, is a minimum.

The specifications for asphalt pavements are very open and many kinds of asphalt have been used. The only material change in specifications which has been made recently is to reduce the amount of stone, sand or screenings which might be used in the surface. Twenty-five per cent. was allowed formerly, but was found hard to work and not entirely suitable to heavy traffic. The guaranty period has been ten years since 1900, and is so continued.

Trinidad asphalt has been used by nearly every contractor laying asphalt, the total yardage existing and replaced in which it was used aggregating nearly 5,000,000. Bermudez asphalt has been used in about 200,000 square yards of pavement; Sicilian asphalt in 30,000; German rock in about 100,000; Alcatraz in about 190,000; Kentucky rock in 175,000; California in about 42,000; Obispo in 27,000; natural rock asphalt in 19,000, and asphalt blocks in about 6,500 square yards.

Macadam streets have been treated with various asphaltic oils and emulsions to prevent dust. The average cost per square yard of making the applications was 1.12 cents. The lighter grades of Aztec and Indian asphaltic oils, Tarvia and Headley's emulsion have been so used.

Brick Pavements in Buffalo, N. Y.

The city of Buffalo, according to the last annual report, has 28.44 miles of brick pavement. The first brick pavement was laid in 1889, but the area paved increased slowly, 1902-3, 1906-7, 1907-8, 1910-11, and 1911-12 being the only years in which more than ten miles length was laid. All pavements are laid under ten years' guaranty and only about one-third the brick pavements in the city are as yet maintained by the city.

The average age of the brick pavements under city maintenance is 16.07 years for streets without car tracks and 16.75 years for streets with car tracks, there being but two of the latter, one 19 and one 14 years old.

The streets repaired in 1911-12 aggregated 51,906 square yards in area and the cost of repairs being $3,161.17, the average cost per square yard of streets repaired was 6.09 cents. The total yardage of streets maintained being 149,808, the cost per square yard of streets under maintenance was 2.11 cents. The number of square yards of brick surface actually repaired being 3,489.24, the cost of making the repairs was 90.6 cents per square yard of surface distributed.

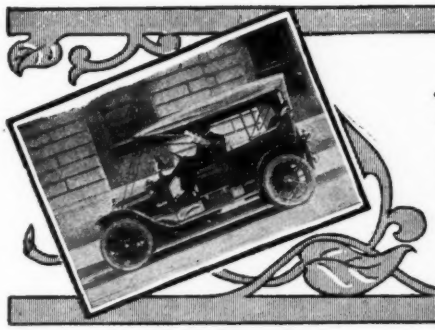
The amount expended for repairs of brick pavements being so small in the aggregate, the economies of repair and resurfacing have not been worked out as they have been for asphalt pavements. The yardage of brick streets maintained is only one-seventh the yardage of asphalt streets under city maintenance. The costs per square yard for the two pavements differ as shown, asphalt costing 6 cents per square yard of streets repaired, 3.94 cents per square yard of streets maintained, and $1.02 cents per square yard of surface actually repaired. The cost per square yard of streets maintained is materially less for the brick streets, and but little different from asphalt when computed by the other two methods.

The cost of brick pavements has varied considerably, beginning with $2.49 a square yard in 1889, increasing to $2.86 in 1892, decreasing rather irregularly to $2.05 in 1901-2 and again increasing with some approach to uniformity of rate to $3.21 in 1909-10. Since that year there has been a decrease to $2.71 in 1911-12.

These figures show that brick pavements are giving satisfaction on economical considerations.

During the past few years the use of brick for the country roads in Erie county outside of Buffalo has increased rapidly, the State Highway Commission having constructed a large mileage of the county roads of brick. These pavements have been described and illustrated in MUNICIPAL ENGINEERING in several numbers recently.

Many kinds of brick are used in these city and county pavements. The records of the brick testing laboratory show bricks from Pennsylvania factories at Kushequa, Calder, Sykesville, Dubois, Reynoldsville, Clearfield, Franklin, Bradford and Youngsville; from Ohio factories at Akron, Conneaut and Collinwood; and from New York factories at Jewittville, Jamestown, Olean, Lockport and Syracuse, the Lockport brick being a sample and the Syracuse bricks old bricks from streets in use.



Automobiles in Municipal Service

Motor Trucks on Street Work

In the work of the Watson Contracting Company, which consists mainly of regulating and grading streets, as well as general contracting work, motor trucks are giving most efficient service. The information presented herewith as to motor truck operation is based on actual work of these trucks as performed on the work of grading several of the avenues and streets in the borough of Bronx, city of New York, on contract calling for a fill of 390,000 cubic yards and a rock cut of 20,000 cubic yards.

All roadbed and paving materials are brought by barges to the dock on the Harlem river at Two Hundred and Seventh street. A floating derrick transfers their contents to a hopper of 30 yards capacity, from which the material is chuted into the trucks standing alongside. The roadbed material consists largely of broken stone, screenings, ashes (purchased from the steamships and power stations) and gravel. Coal, cement, sand, fire brick, asphalt block, flagging and curbing are received at the same dock.

The trucks are equipped with rear-discharge dumping bodies, furnished by the Sior Wagon Company of Brooklyn. They have a capacity of 5 cubic yards. Storage and repairing facilities are provided in a garage on Aqueduct avenue.

Working in two eight-hour shifts, or sixteen hours per day, with two drivers, one of these trucks easily handles 120 yards per day. This is accounted for as follows: The trucks have normal speed of ten miles per hour, but, to be on the safe side, we will figure their average at six miles per hour, or a mile in ten minutes, allowing fifteen minutes for loading and five minutes for unloading (both of which are excessive). This, with the ten minutes running time each way, means forty minutes per round trip, or three round trips in two hours. Therefore in sixteen hours you would have a total of twenty-four round trips, and with five yards per trip, this makes 120 yards per day.

The following is a summary of the operating costs on a daily basis:

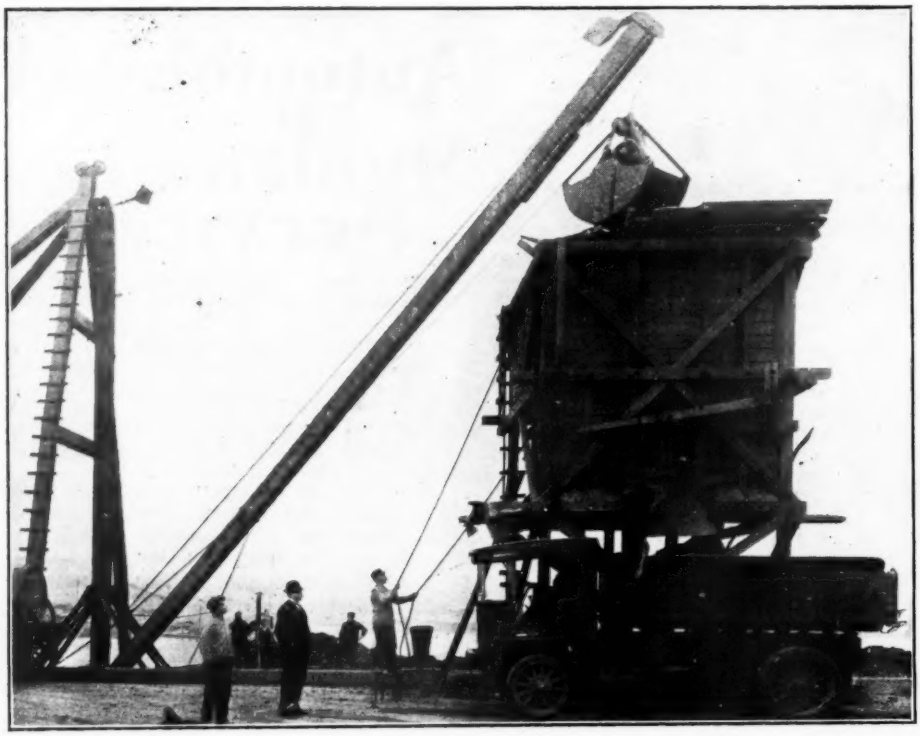
Two drivers at $4.00 per day	$8.00
Gasoline (5 miles to the gallon, 10 gallons at 16c	1.60
Oil and greases per day	.25
Tire expense, 50 miles per day	2.16
Insurance, fire and liability, per day	1.00
Depreciation (less tires, $650.00) based on your job lasting two years and to charge off entire investment 50 per cent. per annum, per day	8.70
Interest, average per day	.75
Repairs (figuring $600.00 in 2 years) per day	2.00

We give the following additional explanation regarding some of the above charges. The tires are guaranteed for 10,000 miles by the tire makers. If you run 50 miles per day for 200 days per year in two years you have made 30,000 miles; deducting the 10,000 miles obtained from the original set of tires on the truck, you leave 20,000 miles to be charged, or two complete sets of tires, cost $1,300, which, distributed over 600 days, makes $2.16 per day. In the repairs we have charged $600, the bulk of which could, of course, come during the second year, and this is probably excessive, but here again we are on the safe side and have averaged the cost over the two-year period.

Thus it may be seen that 120 yards can be hauled daily at an expense of $24.46, or in round figures, about 20c per yard, and we do not see how this can be exceeded.

In the operation of a total number of five six-and-one-half-ton trucks you obtain a six-hundred-yard daily capacity, which, however, is elastic, and when occasion requires your exceeding this amount, it can be accomplished without difficulty. That motor trucks are best for contractor's service is easily demonstrated by the number of contractors who are now using them and the service they are receiving.

Data were obtained from two trips on a five-ton Garford, equipped with a dump-



MOTOR TRUCK *receiving broken stone from bin on dock which is filled from the barge below by means of the bucket and crane.*

ing body of 5 cubic yards capacity, hauling screenings from the dock on Harlem river to Two Hundred and Thirtieth street and Bailey avenue, Bronx. There is a winding roadway from the dock up to University bridge, which makes a hard climb for any fully loaded vehicle. A helper at the unloading point dumped and replaced the body, the chauffeur retaining his seat and shifting the machine once to distribute the load.

First trip.		Odometer reading.	Remarks.	Minutes.
Began loading	10:46			
Finished and left docks.	10:47½	2011.5	Loading time for 5 cubic yards..	1½
Arrived Bailey avenue...	11:02½	2013.2	Running time for 1.7 miles loaded.	15
Dumped and left	11:04½		Unloading time	2
Arrived at dock	11:17½	2015.0	Running time for 1.8 miles empty.	13

Second trip.		Odometer reading.	Remarks.	Minutes.
Began loading	1:04			
Finished and left docks.	1:08	1585.1	Loading time for 5 cubic yards..	4
Arrived Bailey avenue...	1:22	1586.8	Running time for 1.7 miles loaded.	14
Dumped and left	1:25		Unloading time	3
(Delayed 3 minutes by open drawbridge)			Lost time	3
Arrived at dock	1:40	1588.6	Running time for 1.8 miles empty.	12

—Synopsis of Two Trips—

	First trip.	Second trip.
Distance from dock to dumping point..	1.75 miles	1.75 miles
Running time, empty.....	13 minutes	12 minutes
Running time, loaded.....	15 minutes	14 minutes
Time required to load.....	1½ minutes	4 minutes
Time required to unload.....	2 minutes	3 minutes
Lost time due to waits.....	None	3 minutes
Load carried, screenings.....	5 cubic yards	5 cubic yards
Time for round trip of 3.5 miles.....	31½ minutes	36 minutes

MOTOR TRUCKS *dumping cinders in fill for street on work of Watson Contracting Co., Brooklyn, N. Y.*

Weather—Fair.

Streets—Asphalt block. One heavy grade.

Condition of Machine—A-1.

"We operate eighteen Garfords," states Mr. Baisley, a member of the firm. "One of these trucks does the work of at least nine of our best horses. We do a lot of hauling with our machines for other companies. I had always heard that motor trucks weren't profitable on short hauls, and really believed it until just last winter, when we did some work for the New York Catholic Protectory. They had a great amount of coal to be brought up from the dock, which was just a little bit more than a mile away. Our two-horse wagons went to work at it first and could only make nine trips a day. The round trip was 2¼ miles, I think. We decided to try out the machines and soon put the horses in the stable. A truck could make 21 trips a day, hauling five tons, besides having to cover the three miles to our Fordham garage both morning and night.

"The trucks have put the horses out of business except on one or two of our jobs."

A French Motor Tricycle Street Cleaning Machine

The removal of street filth and the cleaning of the wagons, is not at all a small affair, in a city like Paris. The municipality has adopted as a motto "An absolutely clean street at 7 o'clock in the morning," and has made different attempts towards that end, among others the removal of street filth by automobile collectors.

But, manifestly, no motor could withstand the excessive amount of work which it is called upon to perform. It is necessary that the vehicle stop each instant, start up, stop again, etc. The average is 450 stops per night, and it will be understood that such forced labor is very hard on the motor.

Better results have been obtained with another type of electric vehicle and the municipality has decided to employ them on a grand scale.

The street cleaning tricycle, recently experimented with, has given excellent results in the picking up of papers, horse manure, and small filth soiling the street during the day.

By means of a metallic box placed between the two rear wheels, and two rotary brushes, worked by the pedaler himself, the tricycle passes above the matter and makes it disappear; the brushes fold up in the box and the machine passes on, leaving the place behind it clean. The cyclist, seated on his seat, then releases the brushes and continues on his way in search of a new deposit, which he will gather up with ease and rapidity.

A single man can clean up from 10 to 15 miles of street each day.

It is needless to say that the machine has given joy to the Parisian public, for it has proved satisfactory to such an extent that the city of Paris now uses 150 of them.

E. B. Stuart, 36 S. Ashland boulevard, Chicago, Ill., is the American representative of the new street cleaner.

An All-Motor Department

The recent purchase of a triple combination, three combinations, aerial truck and chief's auto gives the distinction of being the first fire department in the country to completely motorize at one time to East Liverpool, O.

They now have one company into the congested district in thirty seconds, three companies in less than three minutes and one company in any part of the city in less than three minutes, thus increasing the efficiency of the department at least 65 per cent.

Motor fire apparatus is three times quicker than horses. This is the secret of successful fire fighting and was the reason why they proceeded from the volunteer to the paid fire department, from the hand to horse-drawn apparatus and finally to motor fire apparatus.

Motor apparatus will get out of the house in from four to eight seconds, while with horses the best time made in this department is twelve seconds. In going up hills they are compelled to walk our horses, as the load is too heavy to drive fast. The motor will make from twenty to thirty-five miles per hour going up the hills. In coming down these hills it is necessary to stop and place a shoe under the wheels and then take it out at the bottom. With motor apparatus it is possible to go down hill at the rate of from ten to fifteen miles an hour without delay and at the same time have better control than with horses.

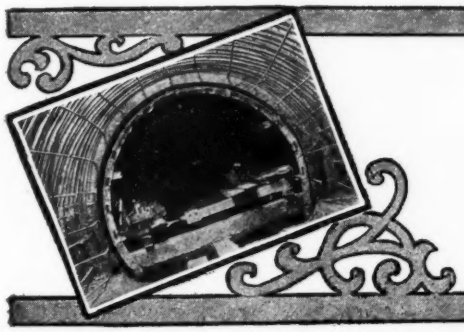
Motor fire apparatus is more reliable than horses. The truck has gone thru mud axle deep and thru thirty inches of snow at the rate of twenty miles an hour, while horses were compelled to walk or go a few yards and then rest. It has gone thru the same mud as the horse apparatus and then pulled the horse apparatus out of the same. It has pulled the horse apparatus out of the snow for over a mile when the latter was disabled. We have gone down 11 per cent. grades, covered with ice, while the horses shod sharp would slide all over the street. Horses, while crossing street railway tracks, will slip and fall, breaking their legs and injuring men. Horses will run away, harness will break, snaps part or come unsnapped. With motor apparatus you have three ways to control these things—one by the foot brake, one by the emergency brake and one by throwing the motor in first or second speed and braking on the motor.

The largest number of accidents with motor apparatus is in turning corners. These have been eliminated by making the driver responsible for any accident. He must turn them slowly, the same as with horse apparatus.

You can train horses every day to come to their harness, and yet they are not reliable. They may come out, turn around and run back in the stall; they may come out and knock down their harness; they may be headstrong and not get under the harness. With the late motor apparatus there are the electric starter, also two separate and distinct ways of ignition. So, if one fails, the other can be relied upon.

The motor-driven triple combination chemical engine, hose wagon and fire engine, which was furnished by the Robinson Fire Apparatus Manufacturing Company, St. Louis, Mo., develops 110-h.p. actual brake test, driving the pump at full capacity with perfect ease and without overload. It also gives abundant power for hill climbing or pulling thru mud or snow. It has vertical-type six cylinders cast in pairs, 6¼-inch bore, 6¾-inch stroke. The pumps are of the latest Robinson design, triplex piston of solid bronze, having a capacity of 1,000 gallons per minute against 120 pounds of pump pressure.

The three motor-driven combination chemical engine and hose wagons, which were also furnished by the Robinson Fire Apparatus Manufacturing Company, St. Louis, develop 80-h.p. actual brake test. This gives abundant power for hill climbing or pulling thru mud or snow. They have vertical-type four cylinders cast in pairs, 6¼ by 6¾ inches.



SANITATION

Sewage Disposal at Chambersburg, Pa.

The electric light plant, the water supply system, the sewer system and sewage treatment plant of Chambersburg, Pa., are owned and operated by the municipality.

Before any work was attempted, council employed an up-to-date boro engineer, who made necessary surveys for the water and sewerage improvements. Consulting engineers were also employed to design the water supply system, sewer system and sewage treatment plants. Plans were made, specifications written, contracts advertised, awarded and carried out on a strictly business basis. Mr. R. M. Huber, the boro's engineer, had immediate charge of all work during the construction period. He had in consultation, for the water supply, the Birkenbine Engineering Offices, Philadelphia, Pa., and for the sewer system and sewage treatment plant, Albright & Mebus, also of Philadelphia.

The water supply is taken from a stream in South Mountain at a point eleven miles from the boro limits. The water-shed lies entirely within the State Forest Reservation, and the water needs no treatment or mechanical lifting. In addition to the main from the mountains, a 2,000,000-gallon storage reservoir and a standpipe were constructed. The cost of the water supply system was over $150,000.

The sewer system presented many difficulties by reason of the fact that the boro is trisected by two creeks, the Conococheague and Falling Spring. These streams have but a slight fall, and their banks are built up to the water's edge. The main outfall sewer, thru the business section, is constructed above the high-water line, on top of a concrete retaining wall at the side of the creek. From a civic improvement standpoint alone, this sewer is worth its cost to the boro, as thereby an unsightly creek bank has been completely transformed and made an attractive feature in the center of the town. The main sewer follows the general course of the Conococheague creek for almost two miles, when it crosses under the creek by an inverted siphon 960 feet long, which terminates in a collecting well, from which the sewage is forced by centrifugal pumps (electrically controlled and driven) thru a force main to the treatment plant, distant about 900 feet.

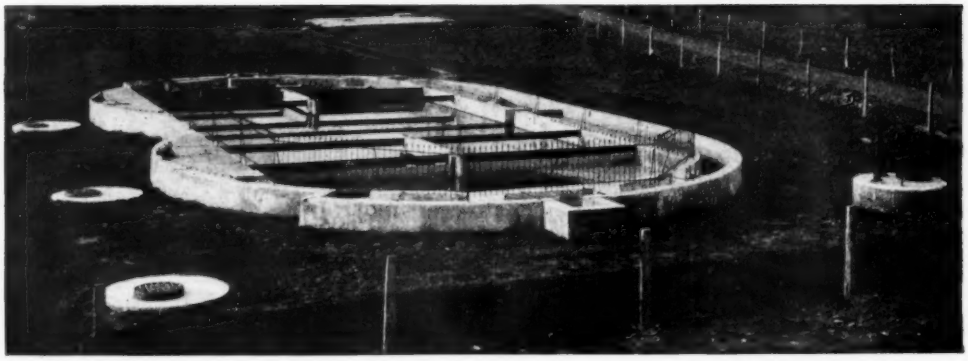
The sewage treatment plant occupies a side hill position, favorable for placing the several units, which consist of settling tanks, a sprinkling filter, secondary settling tanks and a sand filter for drying the sludge from the settling tanks.

The disposal plant consists of two settling tanks, dosing chamber, sprinkling filter bed, secondary settling tank, and sand filter for sludge.

The settling tanks are of Emscher type, circular in plan, built in pairs, and to be used in series. The extreme depth of each tank is 26 feet 4 inches below the weir line. The diameter of the sludge compartment is 26 feet and the extreme width at the top is 36 feet. The settling compartment is 28 feet wide at the top, has an extreme length in plan of 69 feet, and has a depth below water line of 16 feet 9 inches. The capacity of this compartment is approximately 17,000 cubic feet, or 2 hours 10 minutes flow at a maximum flow of 1,000 gallons per minute.

The sewage enters the settling tanks thru four submerged inlets, passes under a wooden baffle in each tank, over a weir between the two tanks, and out thru four submerged outlets to the channel and pipe line leading to the siphon chamber. The force main leads to both ends of the settling tanks, and is equipped with sluice gates set in a manhole, so that the sewage may be passed in at either end and discharged at the opposite end. The purpose is to reverse the flow at regular intervals, so each sludge compartment will receive the same amount of sludge. The channel between the two tanks may also be opened and only one tank used.

The floor of the settling compartment makes an angle of 45 degrees with the



VIEW *of the Imhoff tanks of the sewage disposal plant at Chambersburg, Pa.*

horizontal, sloping from both sides down toward the longer axis of the tanks. The sloping sides do not meet at the apex, but form an opening of 8 inches next to each side of a wedge-shaped beam, running along the center line of the tanks. The openings allow the sludge settling on the sides to slide down into the sludge well, and the base of the wedge-shaped beam prevents the gases arising from decomposition going up thru fresh sewage, but they are deflected and pass thru the sludge compartment and out thru openings on the sides of the settling compartment.

The floor of each sludge compartment or well is an inverted cone. The sludge is removed thru a cast-iron sludge removal pipe, set in the wall at the apex. The head of water available for forcing out the sludge is 10 feet. The discharge end of the sludge removal pipe is placed in a manhole on a 10-inch terra cotta drain leading to the sand filter for sludge. The sludge wells have a capacity of four months for 12,000 people.

The dosing chamber has a capacity of 9,000 gallons and is fitted with a Miller automatic flushing siphon capable of delivering sewage to the Taylor hexagonal nozzles at the rate of 2,000 gallons per minute for the head, varying from 5 feet to 18 inches above the orifices of the nozzles. Piping and valves are to be provided, so the dosing chamber may be emptied on the sludge bed and the sewage by-passed to the nozzles.

The sprinkling filter bed has an area of 0.46 acre, and is 160 feet 3 inches long and 125 feet wide on top. The bed is of such size that it will be dosed at the rate of 1,700,000 gallons per 24 hours, at a maximum rate of flow. A cast-iron feed pipe, 18 inches in diameter (but terminating in 14-inch pipe), leads from the siphon chamber to and along the upper side of the bed. From the feed main cast-iron lateral distributing pipes, beginning with 8-inch and ending with 6-inch, are laid thru the body of the bed about 3 feet below the surface of the stone. Each lateral pipe has a valve inserted near the feed pipe, so any line of nozzles may be cut off at will. The spacing between the lateral pipes is 11 feet 3 inches, center to center, and the spacing of the riser pipes which feed the nozzles is 13 feet, center to center. There are 126 full and 14 half nozzles of the Taylor patent.

The filtering material is crushed limestone, ½ to 4-inch sizes, carefully cleaned and spread to a depth of 6 feet at the upper end and 6 feet 9 inches at the lower, next to the collecting channel. The outside supporting walls on three sides are of rough stone, laid up dry. On the upper side there is a light concrete wall, which acts merely as a dividing wall between the earth and crushed stone. The floor and collecting channels are of concrete. The underdrains are made of cement and sand. The design provides ample openings for ventilation thru the stone, and, in addition, each row of tile is ventilated at the upper end by a 3-inch terra cotta pipe brought to the surface. Flushing may also be done thru these vents.

The effluent from the sprinkling filter is collected by a concrete open channel at the lower side, and is conducted to three small settling tanks having a combined capacity of about 45,000 gallons. The tanks are 15 feet wide, 50 feet long and 4½ feet deep. The floor slopes to sumps, from which the sludge is forced out thru a sludge pipe to the sand filter by the head of water that may be obtained by filling a tank. The top walls of the channel and second settling tank are above the level of high water. The effluent from the sand filter and the secondary settling tanks is discharged in deep water in the creek.

Three-inch riser pipes are set in the

6-inch and 8-inch distributing pipes in the filtering material. Bronze nozzles of the Taylor type for hexagonal areas were used. The sprinkling filter stone varies in size from 1½ inches to 3 inches. This material was properly cleaned and screened. No teaming was allowed over the filter bed, the media being placed from industrial cars and tracks. The top level of the media was fixed at 6 inches below the orifices of the nozzles.

The sand filters for sludge are rectangular in plan and are 60 feet by 90 feet inside bottom dimensions. The sides are earth embankments with slopes of 2 to 1. The soil was removed from the natural surface before the embankments were built in 6-inch layers, which were thoroly compacted by rolling. The floor of the sludge bed is ridged and the 6-inch terra cotta drain pipes are laid in the troughs. The underdrains are laid to grade. A layer of crushed stone, size 1½-inch, was laid over the floor of the sand bed so as to fill the valleys between the ridges. On top of the 1½-inch stone a 3-inch layer of smaller stone, varying in size from ¼ to ½ inch, was spread. On top of this smaller layer a course of clean sand was spread.

Garbage Disposal in Chicago

The question of garbage disposal has reached an acute stage in Chicago, the dispute between the city and the former contractor for disposal and the inability of the city authorities to decide upon new methods of disposal have continued until the old contract expired and have resulted in a refusal of the contractor to continue pending settlement of the question, so that now the property owners are begged to dispose of the garbage as nearly as possible upon their own premises, and the city is treating with chemicals what it must collect before dumping it in abandoned clay holes.

The discussion has resulted in the presentation of much information of greater or less value upon the comparative values and costs of various methods of disposal. The following figures are taken from comparative estimates made by M. de Ronore, of Paris, France, who is the general manager of the French company which has developed the mixed method of garbage disposal which was described in a recent number of MUNICIPAL ENGINEERING.

An assumption of 1,000 tons of material for disposal per day is made, of which, according to the Parisian average, 40 per cent. will be garbage and street sweepings and 60 per cent. dry combustible rubbish. The average cost for incineration of wet garbage is said to be $2 a ton and that of incinerating a mixture of equal parts of dry waste and wet garbage over 50 cents a ton. The dry combustible rubbish has a calorific value one-fifth that of good coal while the mixture with garbage has no calorific value.

The mixed method of garbage disposal produces a fertilizer weighing about 20 per cent. of the garbage treated, this weight being about one-half that of the portion of the garbage reducible to fertilizer. The remaining three-fifths of the mixture is burned and produces electrical energy. The cost of a plant of twelve groups, each group with a capacity for 10 tons per hour is estimated as follows:

Land, 4.5 acres to be furnished by city is not included.

Buildings for the plant	$ 300,000
Offices and lodgings	60,000
The Mechanical Installations—	
Wagon-loading apparatus	$ 60,000
Sorting, crushing, etc., machinery	80,000
Producer system incinerators	220,000
Boilers	120,000
Electrical machinery	180,000
Expenses, loading, freight, etc., on construction materials and machinery	30,000
Paving about plant	50,000
Conduits and pipes for water and electricity	80,000
Side track	40,000
Miscellaneous	40,000
Contingencies	80,000
Total estimated cost of plant	$1,340,000

The cost of operation of this plant is not stated, but the amount of labor required is estimated at somewhat less than twice that required in an incinerator plant and about one-fifth that required for a reduction plant of about the same capacity.

The income from the plant using the mixed method is estimated as follows:

The 400 tons of organic matter per day will produce 200 tons of fertilizer or 73,000 tons per year, this is valued at $5 a ton, or $365,000 a year. The combustible waste is estimated to produce 50 k.w.-hr. of electricity per ton and the 600 tons per day (219,000 tons per year) would produce 10,950,000 k.w.-hr. per year. Deducting 2,190,000 k.w.-hr. required about the plant leaves 8,760,000 k.w.hr. for sale, which, at 2 cents would produce $175,200. The total gross income from the plant for year would therefore be $530,-200. In addition there would be income from sale of rags, metals, etc., recovered.

These estimates may not fit American conditions exactly but can be modified to fit them and are certainly interesting. Even after deducting an expense of operation equal to that of running an incinerator plant with the addition of the greater labor cost in the mixed method plant, at say $1 a ton incinerated, a handsome profit remains for the mixed method.

MISCELLANEOUS

Settlement in Randolph Street, Chicago

On December 2, 1913, at 10:45 p. m., the Chicago Water Department received an emergency call to Randolph street, between Wabash avenue and Holden court, that a main was broken. It was shut off by 11:05 and examination showed that some of the joints in the 12-inch pipe laid in the street had pulled apart due to the caving in of the excavation made for an addition to the Marshall Field building.

Necessary repairs were made at once and the main was put in service, tho it was necessary to shut it off late while repairs to the sewer, made necessary by the cave-in, were made a day or two later.

Careful examination of the cave-in was made at once by Hugh E. Young and A. B. Callander, representing the city engineer, and H. C. Lummis and H. T. Cooper, representing Mr. Weston, and by a commission consisting of George Weston, John Ericson and John A. Dailey.

This investigation showed that the excavation for the basement and foundation of the addition to the Marshall Field building had proceeded to a depth of about 34 feet below the sidewalk level and had been extended out to the curb line. The columns supporting the building extended down some 8 or 10 feet deeper and supported the basement floor 13 feet below the sidewalk and the sub-basement floor 29 feet below it. Sheet piling made up of fabricated sections composed of No. M-102 and a 12-inch 40-lb. I-beam, had been driven at the curb line to a depth of 48 feet, or about 15 feet below the bottom of the main excavation of the basement, but the excavation had been carried about 9 feet deeper in a trench next the sheet piling, such trench being perhaps 8 feet wide, and the bottom of this trench was only 6½ feet above the bottom of the piling. Footings for the sheet piling to carry the floor loads coming on it were not provided on this Randolph street side of the building, tho they were provided on the Washington street section, the omission said to have been by mistake.

The sheet piling was braced by the sidewalk floor beams at the top; by 15-inch 65-lb. I-beams, reinforced, in the plane of the basement floor, 13½ feet down, by 15-inch I-beam knee braces on each side of the floor beam and supporting a tile floor; and by 15-inch 42-lb. I-beam struts at the sub-basement level, 15 feet farther down. The trench excavation extended below the subway floor line, 14 feet still farther down, but there was no bracing here nor at the base of the sheet piling. This excavation was presumably made for the purpose of building the subway floor from the sheet piling to the columns of the building.

The bracing beams all extend from the sheet piling to the building columns, into which they are framed, being connected to the sheet piling by angles. The beams in the sub-basement floor, which act also as struts, were incased in a 14-inch plain concrete floor, part of which had fallen out after the accident, the remainder being readily picked out.

Between the first two columns counting west from Wabash street the excavation had been made only slightly below the sub-basement floor, and there was practically no settlement at the first column and but little at the second. The trench next the sheet piling had been excavated from about the third column on west to the court, and here the settlement was serious, the sheet piling having moved in toward the building from a few inches to 3 feet at the level of the bottom of the general excavation, which was, as stated above, about 5 feet below the sub-basement floor.

At the level of the sub-basement floor the movement was from several inches to 2 feet, and the floor beams embedded in the concrete had buckled entirely out of line, some of them falling to the plank floor laid on the ground below.

At the level of the basement floor the movement was also toward the building and the floor beams were buckled out of line.

At the sidewalk level the sheeting had moved out from the sidewalk and former curb line.

At the same time it was found that the sheet piling had sunk from some inches to 2 feet along Randolph street, and less

than ½ inch along the Wabash street side. The sidewalk along Randolph street had settled from a few inches to 3 feet.

From the conditions shown above and the further assumptions that the angle of repose of the earth fill in the street would be 30 degrees with the horizontal and that its weight was 111 pounds per cubic foot, also that there was no hydrostatic pressure, tho below the city datum, no live loads and no weights of adjacent buildings, it was computed that the sheet piling, unbraced at the bottom, was wholly unable to carry the load, the pressure on the sub-basement floor beams, for example, being seven and one-half times their ultimate strength. After these beams failed the load on the basement floor beams became 1.3 times their ultimate strength, and would have been fully three times that strength if the sheet piling could have transmitted it, not considering the eccentricity of the load.

The bearing value of the sheet piling was only 0.685 of the loads on it, showing that when sheet piling is used to carry floor loads, as in this building, it should have adequate footings, friction on the mud or wet clay found below datum being too uncertain.

The excavation of the trench along the piling without sufficient temporary bracing at sub-basement and subway levels is held responsible for the lateral movement of the earth, and the consequent settlement of the street, the former showing a movement of 265 cubic yards and the latter of 300 cubic yards.

There is a 30-inch brick sewer in Randolph street, with double ring invert and single ring arch, which is 32½ feet north of the south line of the street. After the accident water ran into this sewer from both ends, and thence by some connection thru a chute into the Illinois tunnel. The sewer was dammed off on the day following the accident and the work of relaying it was begun on the next day, the John Griffiths & Son Co., contractors for the building, doing the work or contracting for it. About 170 feet of the sewer was reconstructed, the settlement for about 100 feet of this distance being nearly or quite 4 feet vertically and the maximum lateral movement about 1 foot.

The brick work of the old sewer was excellent and showed no breaks or distortion of cross-section, even after the settlement, the joints being somewhat loosened where the settlement was a maximum.

Neither sewer nor water main were in any way responsible for the break; on the other hand, the settlement and movement of the earth was responsible for the breaks in the water main and the settlement of the sewer.

The pavement was buckled by the moving outward of the upper ends of the piling and was settled out of shape by the settlement of its supporting earth.

An Engineer for the Interstate Commerce Commission.

The American Institute of Consulting Engineers has written a letter to President Wilson giving him a number of good reasons for appointing an engineer as one of the members of the Interstate Commerce Commission, first assuring him that the Institute has no candidate to present. The leading part taken by the engineer in the location, construction and operation of railroads, his familiarity with all the details of the complex problems involved in the economics of railroad construction and operation and in their application to railroad rate determination, his intimate knowledge of all the problems coming before the commission, from safety appliances to rate regulation, are emphasized. It is also stated that in addition to this knowledge and experience the engineer appointed should have a judicial temperament, executive ability and tact.

The New York State Asphalt Inquiry

Inquiry of those mentioned in the investigation of the methods of manipulating specifications for asphaltic materials for use on the roads constructed under the New York State Highway Commissioner has brought a letter from D. T. Pierce of the Barber Asphalt Paving Company, from which the following extracts are taken to show the position they occupy in the controversy:

"The highway specifications in the State of New York cover materials of all kinds, including 'natural solid asphalt' and oil asphalt. For a large amount of work both the oil asphalts and the natural asphalts are specified. This company has never had and never sought a monopoly; and if it did seek it, it has never obtained it, since the awards for oil asphalts far exceed those for natural asphalt, namely, Trinidad or Bermudez.

"Last summer, about June, the Warner-Quinlan Company set up the claim that it should be allowed to supply Montezuma asphalt, an oil product, under the natural solid asphalt specification. It claimed that Montezuma was a solid natural asphalt, although it is admittedly made from Mexican petroleum, which, of course, is a liquid. The attempt to substitute Montezuma for natural asphalt was considered by the Highway Department; some oil asphalt was accepted un-

der the natural asphalt specification, and then the department refused to accept any more of it.

"When the administration changed and Mr. Carlisle became highway commissioner, he notified all contractors that the specifications must be lived up to, and that no oil asphalt would be accepted under the natural asphalt specification. Following this decision the Warner-Quinlan Company brought charges against the commissioner, alleging unfair discrimination, because, as stated, the commissioner refused to accept oil asphalt under the natural asphalt specification; the Warner-Quinlan Company contending that its asphalt, tho made from liquid petroleum, is a solid; that is, that it is as solid as, or more solid than, the natural asphalt.

"I have given the claims of the two sides as fairly as I know how to do it.

"The charges against Mr. Carlisle, heard by a commission appointed by the Governor, developed in the course of the hearings that the Warner-Quinlan Company could have delivered solid natural asphalt if it had desired to do so, but that it preferred naturally to substitute oil asphalts, the cost of which is far less than the cost of natural asphalt, which it had supplied to the State in large quantities prior to obtaining supplies of Mexican oil. It is our intention in due course to present a very full statement regarding this whole matter, as the company's position and the facts of the case have been grossly distorted."

Designers of the Atlanta Sewage Disposal Plants

The photograph of Dr. Karl Imhoff, Superintendent of Construction R. M. Clayton and Assistant Superintendent of Construction W. A. Hansell, Jr., on page 521 of the December number has a caption naming these gentlemen as "The engineers responsible for the Atlanta sewage disposal plnat."

Mr. Hansell writes to say that Dr. Rudolph Hering, then of the firm of Hering & Fuller, was the designer of the plant and that Mr. Clayton and himself are entitled only to credit "for the carrying out of this splendid design." The desire of these engineers to give full credit to Dr. Hering is most commendable, but the article and the statements in it are regarding the construction and the responsibility of the city's engineers for the excellent results obtained, which are due largely to their good judgment in securing the services of Dr. Hering, but are also due largely to their own intelligent, painstaking effort in carrying out the plans obtained as the result of that judgment.

Cameron Patents on Septic Process Owned by Cameron Septic Tank Co.

The Editor of MUNICIPAL ENGINEERING:

Sir—In your December issue a letter appeared under the heading, 'Patents on Springfield Sewage Disposal Details," signed by the Sterilization Company, Newark, N. J., in which the statement is made that the Cameron septic process patent is controlled by that company.

The statement is not true, and as the Sterilization Company, ignoring our written request to retract it, has failed to do so, we ask that you publish this letter as notice to your readers that the statement referred to is entirely unwarranted, and further, that ownership and control of the Cameron septic process patent is vested in the undersigned.

H. D. WYLLIE,
Manager Cameron Septic Tank Co.

New Orleans Water Filtration.

George G. Earl, general superintendent of the New Orleans Sewerage and Water Board, calls attention to the omission of New Orleans from the list of Southern cities filtering their water supplies, published in the December number, and the unintentional slip of memory is hereby acknowledged with thanks to Mr. Earl for his courtesy.

The Road Builders' Convention

The American Road Builders' Association held a very successful convention at Philadelphia, December 9 to 12. Over 2,500 registered, all actually interested in road building, and the attendance at the meetings was large. Nearly a hundred manufacturers and dealers were represented in the exhibits, including the following:

Acme Machinery Co., Frankfort, N. Y.
American Rolling Mill Co., Middletown, Ohio.
Amies Road Co., Easton, Pa.
Art Stone Co., Waynesboro, Pa.
The Autocar Co., Ardmore, Pa.
The Bain Wagon Co., Kenosha, Wis.
R. D. Baker & Co., Home Bank Building, Detroit, Mich.
Barber Asphalt Paving Co., Land Title Building, Philadelphia, Pa.
Barrett Manufacturing Co., New York.
Blanchard & Hubbard, Consulting Engineers, Broadway, New York City.
Bausch & Lomb Co., Rochester, N. Y.
Bucyrus Co., South Milwaukee, Wis.
Buff & Buff, Jamaica Plains, N. Y.
Buffalo-Pitts Co., Buffalo, N. Y.
E. E. Buhler & Co., 103 Park avenue, New York.

The Philip Carey Co., Cincinnati, Ohio.
J. I. Case T. M. Co., Racine, Wis.
Champion Wagon Co., Oswego, N. Y.
Clip-Bar Mfg. Co., 2546 Oliver street, Philadelphia, Pa.
Columbia Wagon Co., Columbia, Pa.
Concrete Form and Engine Co., Detroit, Mich.
The Dolarway Paving Co., 17 Battery place, New York City.
The Dunn Wire-Cut Lug Brick Co., Conneaut, Ohio.
The Dustoline for Roads Co., Summit, N. J.
Eagle Wagon Works, Auburn, N. Y.
A. B. Farquhar, York, Pa.
The Frick Co., Waynesboro, Pa.
Galion Iron Works and Mfg. Co., Galion, Ohio.
Good Roads Machinery Co., Kennett Square, Pa.
W. & L. E. Gurley, Troy, N. Y.
The William Hartranft Cement Co., Inc.
Hassam Paving Co., Worcester, Mass.
Headley Good Roads Co., Real Estate Trust Building, Philadelphia, Pa.
Huber Mfg. Co., Marion, Ohio.
R. W. Hunt Co., Consulting Engineers, Chicago, Ill.
Charles Hvass & Co., 509 East Nineteenth street, New York City.
Ingersoll-Rand Co., 11 Broadway, New York.
Ingraham-Richardson Enameled Sign Co., Beaver Falls, Pa.
Iroquois Iron Works of Barber Asphalt Co., Buffalo, N. Y.
The Jennison-Wright Co., Toledo, Ohio.
Kent Machine Co., Columbus, Ohio.
Kentucky Wagon Mfg. Co., Louisville, Kentucky.
Keuffel & Esser Co., Hoboken, N. J.
The Knickerbocker Co., Jackson, Mich.
Koehring Machine Co., Milwaukee, Wis.
The Lansing Co., Lansing, Mich.
Lehigh Portland Cement Co., Allentown, Pa.
Link Belt Co., Nicetown, Pa., and Chicago, Ill.
Locomobile Company of America.
McAvoy Vitrified Brick Co., 1345 Arch street, Philadelphia, Pa.
Merchant & Evans Co., Arch street, Philadelphia, Pa.
Alexander Milburn Co., Baltimore, Md.
Marion Steam Shovel Co., Marion, Ohio.
National Paving Brick Manufacturers' Association, Cleveland, Ohio.
Oliver Chilled Plow Co., South Bend, Ind.
Packard Motor Car Co., Detroit. Mich.
W. H. Pickett Co., Inc., 214 Harmon Building, Philadelphia, Pa.
Rapid Mixer Co., Grand Rapids, Mich.
Robeson Process Co., Pennington, N. Y.
Rocmac Road Corporation of America, Lafayette Building, Philadelphia, Pa.
J. J. Shannon, 1744 Market street, Philadelphia, Pa., representing Chicago Concrete Machinery Co., and T. L. Smith Co., Milwaukee, Wis.
Standard Oil Co., Broadway, New York.
Steel Protected Concrete Co., Philadelphia, Pa.
Tarrant Manufacturing Co., Saratoga Springs, N. Y.
The Texas Co., 17 Battery place, New York City.
The Thew Automatic Shovel Co., Lorain, Ohio.
Troy Wagon Works, Troy, Ohio.
Trussed Concrete Steel Co., Detroit, Mich.
Waring Underwood Co., Commercial Trust Building, Philadelphia, Pa.
Union Iron Works, Hoboken, N. J.
United Gas Improvement Co., Philadelphia, Pa.
United States Asphalt Refining Co., 90 West street, New York.
United States Wood Preserving Co., 165 Broadway, New York.
Universal Road Machinery Co., Kingston, N. Y.
Universal Portland Cement Co., Chicago, Ill.
Warner Quinlan Asphalt Co., 79 Wall street, New York.
Warren Bros., Boston, Mass.
Warren-Knight Co., Philadelphia, Pa.
Waterloo Cement Machinery Corporation, Waterloo, Iowa.
Watson Wagon Co., Canastota, N. Y.
Wheeling Corrugating Co., 402 Broad street, Philadelphia, Pa.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Wiard Plow Co., Batavia, N. Y.
Yellow Pine Manufacturers' Association, St. Louis, Mo.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

January 7—Civil engineer student in Office of Public Roads, Department of Agriculture, at $720 a year.

January 7, 8—Topographic draftsman and copyist topographic draftsman at $1,000 to $1,500 and $900 to $1,500 a year, respectively.

January 21, 22—Bureau of Standards, Department of Commerce; laboratory assistant at $900 to $1,200 a year; aid at $600 to $720 a year; laboratory assistant in petrography at $1,200 a year.

January 21, 22, 23—Inspector of mechanical and electrical engineering, office of Supervising Architect of the Treasury, at $2,000 a year.

February 4—Topographic aid under Geological Survey during field season at $40 to $75 a month.

February 5, 6—Junior topographer in Geological Survey at $720 to $1,200 a year.

Technical Schools

The civil engineering department of the University of Illinois announces a short course in highway engineering to be given from January 19 to 31. It is intended as a help to the new county superintendents of highways and is open without charge to all who aspire to positions as county or township road supervisors. Three or more lectures each day, laboratory work in testing and examining road materials, use of road machinery, are included in the program.

The University of Illinois has published a revised and enlarged edition of "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," which it will send for 50 cents.

The College of Engineering of the University of Wisconsin is making tests to determine the rate and amount of flow of water thru concrete with special reference to methods of making concrete water-tight. Some interesting results have already been obtained and studies are in progress of variations in percentages of material, gradations of sizes of rock, gravel and sand, methods of mixing, etc.

The announcements of the Columbia University graduate course in highway engineering show that the courses are given in periods of 2 to 4 weeks each so that men at work can take them during brief leaves of absence. Suggestions of such groups of courses covering various periods of time are made by the department and can be obtained of Frank D. Fackenthal, the secretary of the university. Two winter periods of four months each are required for the master's degree. The Davis library of highway engineering is said to be the most complete collection of books on highway engineering and allied subjects in this country.

Technical Associations

Col. George W. Goethals, chief engineer of the Isthmian Canal Committee, has consented to act as honorary president of the International Engineering Congress to be held in connection with the Panama-Pacific International Exposition in San Francisco, Cal., in 1915 under the auspices of the five national engineering associations. The sessions will be held during the week of September 20-25, 1915, and will be in charge of eleven sectional organizations. W. F. Durand, Foxcroft building, San Francisco, Cal., is chairman of the executive committee.

At the meeting of the New England Water Works Association on December 10 papers were presented by X. H. Goodnough, chief engineer of the State Board of Health, on "Rainfall"; N. W. Akimoff of Philadelphia, "On Flow in Bends"; H. P. Letton of Washington on "Small Water Purification Plants," a plea for their more efficient operation; and there was a topical discussion on methods of locating hidden leaks in underground pipes with special reference to pipes whose actual location is unknown.

The Indianapolis-Lafayette section of the American Institute of Electrical Engineers at its meeting December 5 heard a paper by Richard Fleming on "Applications of Electro-Chemistry to Industry."

The National Conference on Concrete Road Building, to be held in Chicago February 12, 13 and 14, in conjunction with the cement show, has published a long list of prominent engineers, educators and others as members of its advisory committee, of which W. F. M. Goss is chairman and J. P. Beck, 72 West Adams street, Chicago, is secretary.

The National Brick Manufacturers' Association will meet in New Orleans, March 2 to 7, the week following Mardi Gras. A special trip to Panama can be taken at the close of the convention.

The annual meeting of the Brooklyn Engineers' Club was held December 11 and the annual dinner on December 18. E. J. Fort was elected president and Joseph Strachan was re-elected secretary.

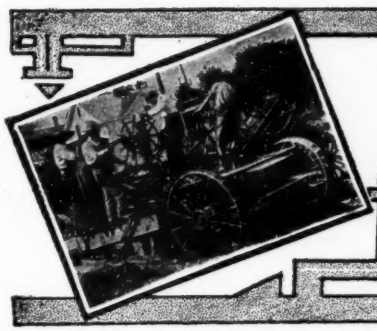
The American Highway Association will hold its next meeting with the American Road Congress at Atlanta, Ga., October 19 to 26, 1914. J. E. Pennybacker, secretary, Washington, D. C.

The American Wood Preservers' Association will hold its convention in New Orleans January 20 to 22.

At the December meeting of the Colorado Association of members of the American Society of Civil Engineers the discussion on the valuation of public utilities was continued. Leonard Metcalf of Boston was present and contributed thereto.

Personal Notes

In August, 1913, J. W. Howard, consulting engineer on pavements, a resident of Newark, N. J., made a report upon the plans and specifications of a wood block pavement proposed for Newark, which was used as the basis of a veto by Mayor Jacob Haussling of Newark, of the ordinance ordering the paving. Chief Engineer M. R. Sherrerd made some remarks at a public meeting of the Board of Street and Water Commissioners following the veto which were published in the daily papers of the following day. These statements are held by Mr. Howard to have caused him to suffer in his reputation and to lose the good will and trade of many persons, cities and officials of cities, and he has entered suit, claiming $10,000 damages therefor.



MACHINERY AND SUPPLIES

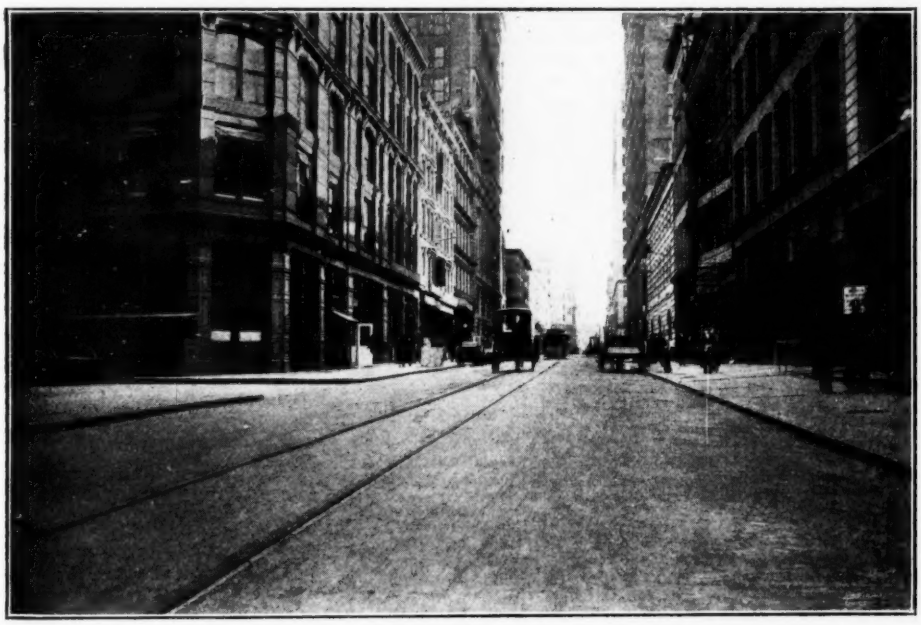
Creosoted Wood Block Paving in New York

By H. W. Durham, Chief Engineer in Charge of Highways, Borough of Manhattan, City of New York.

The first creosoted wood block pavements in the borough of Manhattan, city of New York, were laid in 1904 on Warren street, between Broadway and Greenwich streets; Twentieth street, between Broadway and Fifth avenue; Ninety-Eighth street, between Central Park West and Columbus avenue. These three streets were selected as representing a heavy, medium and light traffic, and the pavements were laid with the idea of observing the wear under the three different conditions.

These blocks were impregnated with a mixture of creosote oil and resin, equal parts, about twenty pounds of the mixture being injected into a cubic foot of wood. The size of the blocks was 3 inches wide, 8 inches long and 4 inches deep. They were laid close together, the joints being filled with a cement grout or sand on a bed of cement mortar ½ inch thick, which in turn was laid on a concrete foundation 5½ inches thick of the proportions of one part of cement, three of sand and five stone. Very few repairs have been made on these streets to date, although they have been subjected to exceedingly severe service.

During the year 1910, 3.57 miles of creosoted wood block pavement was laid, as against 2.29 in 1909. The principal work was on Delancey street, from the Bowery to the East river, excepting a small portion at the bridge entrance. A contract



CREOSOTED WOOD BLOCK PAVEMENT *on a New York heavy traffic business street with single car track.*

was let in that year which was carried out early in 1911 for paving with creosoted wood block the extension of Delancey street from the Bowery to Lafayette street, so that when it was completed there would be a first-class pavement the whole length of Delancey street. The work in 1910 cost $3.20 per square yard, as against $3.34 in 1909.

Those pavements completed in 1910 were yellow pine four-inch blocks; foundation 5½ inches, binder ½ inch cement mortar on the following streets:

Location.	Former Pavement.	Length.	Width Paved.	Yardage.	Price per sq. yd. inc. foundation.
Avenue A, Houston to 24th	Houston-23rd, G. B. 23d-24th, Belg	5,919	42	22,982	$3.09
Bedford st., Houston to Grove	Granite Block	1,256	20	2,835	3.35
Cannon st., Rivington to Houston	Belgian Block	814	25	2,287	3.50
Delancey st., East to Ridge	Belgian Block	2,215	21 to 60	7,567	3.31
Delancey st., Essex to Chrystie	Granite Block	1,571	81	13,109	3.39
Lewis st., Grand to Delancey	Belgian Block	666	26	1,898	3.50
Washington Sq. S., Wash. Sq. E. to Wash. Sq. W.	Sheet Asphalt	1,010	32 to 27	3,295	3.42
1st ave., 25th to 26th, 28th to 29th	Sheet Asphalt	453	60	3,000	3.03
2nd ave., 23rd to 37th, 48th to 53rd	Belgian Block	4,960	45	25,090	3.50

During the year 1911 4.63 miles of creosoted wood block paving was laid on completed contracts and 1.22 miles on contracts in progress at close of the year, making a total of 5.85 miles laid during 1911. These pavements were laid on streets with slight grades, where the traffic was heavy and a smooth pavement was desired. The average cost per square yard on a six-inch concrete foundation was $3.56, as compared with $3.20 in 1910 and $3.34 in 1909. These blocks, mostly yellow pine, were laid on a one-inch sand cushion on a six-inch concrete foundation on the following streets:

A committee appointed by the Board of Estimate and Apportionment, consisting of the pavement engineers of the different city boroughs, together with the chief engineer of the board and the chief engineer of the Finance Department, to prepare a standard specification for creosoted wood block pavement, have adopted a specification omitting resin entirely and having the following requirements for the treatment of blocks:

The blocks shall be so treated with an oil elsewhere described that the pine blocks shall contain not less than 20 and the gum blocks not less than 22 pounds per cubic foot. After treatment the blocks are to show such waterproof qualities that after being dried in an oven at a temperature of 100 degrees C. for a period of 24 hours, weighed and then immersed in clear water for a period of 24 hours and again weighed, the gain in weight is not to be more than 3½ per cent. for pine blocks and 4½ per cent. for gum blocks.

The oil with which the blocks are to be treated shall be a stable, antiseptic and waterproofing oil, from which the

Location.	Former Pavement.	Length.	Width Paved.	Yardage.	Price per sq. yd. inc. foundation.
Avenue B, Houston to 14th	Sheet Asphalt	3,436	30	6,479	$3.58
Avenue C, Houston to 12th	Sheet Asphalt	2,821	30 & 42	7,880	3.53
Delancey st., 83 ft. w. of Chrystie to Bowery	Sheet Asphalt	185	106	1,467	3.53
E. B'dw'y, Scammell to Gouverneur	Sheet Asphalt	278	52	1,135	3.54
Kenmare st., Bowery to Lafayette	Sheet Asphalt	917	42	4,282	3.18
Lafayette st., 129 ft. near Spring	Granite Block	274	48	1,460	3.38
Norfold st., Hester to Houston	Sheet Asphalt	2,202	25	6,088	3.50
Pitt st., Broome to Houston	Sheet Asphalt	1,627	25	4,409	3.48
Sheriff st., Broome to Houston	Sheet Asphalt	1,626	26	4,465	3.48
Sullivan st., Canal to Wash. Sq. S.	Sheet Asphalt	3,702	32-32-24	9,978	3.41
2nd ave., intersection of 28th	Sheet Asphalt	77	60	342	3.74
2nd ave., 74th to 83rd	Sheet Asphalt	2,491	60	12,246	3.45
23rd st., 10th ave. to 11th ave	Granite Block	817	40	2,279	3.18½
34th st. (as widened), Madison to 8th ave.	Sheet Asphalt	3,066	53	12,854	3.54½
111th st., 5th ave. to E. Lenox ave.	Asphalt Block	944	30	3,146	3.35

water has been removed by distillation, and which shall have a specific gravity of not less than 1.12 at 38 degrees C. When distilled in a manner hereinafter described the oil shall lose not more than 35 per cent. up to a temperature of 315 degrees C. The distillate between 255 degrees C. and 315 degrees C. shall have a specific gravity not less than 1.02, the said specific gravity being taken at a temperature of 60 degrees C.

The popularity of creosoted wood block as a paving material is illustrated by its present use. The city of New York alone awarded in 1912 contracts amounting to 320,000 square yards, while the amount laid in the United States previous to December 31, 1911, was 10,000,000 square yards, and it was estimated that 2,500,000 square yards was laid in 1912. The cost of this pavement varies according to local conditions and specifications, but it averages from $3.25 to $3.50 per square yard, the blocks being 4 inches deep, laid on a foundation of Portland cement concrete 6 inches thick.

The borough of Manhattan has three streets which have been out of guarantee three years—one of heavy traffic, one of medium traffic and one of light traffic. The heavy traffic has cost 7 cents per yard per year, while the average of all has been 6 cents per yard per year; but it should be explained here, as in the case of borough of Brooklyn streets, that the repairs have been due to wear and tear only on the heavy traffic street, which is a wholesale street in the business section. Repairs on the other streets are due to settlements over trenches, damage caused by fire and practically nothing to wear and tear of traffic.

In the borough of Brooklyn, New York City, the first creosoted wood block pavement was laid in 1902, without any guarantee, and has cost practically nothing for repairs. Some streets have been opened for subsurface work, and the engineer in charge of pavements states that in his opinion practically all of the repairs are due to settlements over trenches and damage caused by fires, and not from actual wear and tear of traffic. In this borough no expansion joints are provided for, and very little trouble has been caused by bulging when the material has been yellow pine and when the absorption test has been maintained. The result of this experience would seem to demonstrate that in the climate of New York City, at least, no expansion joint is necessary.

Our specifications, in brief, provide:

Kind of Wood—Southern long leaf yellow pine.

Size of Blocks—8 inches long, 3 inches wide, 4 inches deep.

Treatment (Character)—Oil to be a stable, antiseptic and waterproofing oil, from which the water has been removed by distillation, and which shall have a specific gravity not less than 1.10 at 38 degrees C.

Treatment (Amount)—20 pounds per cubic foot.

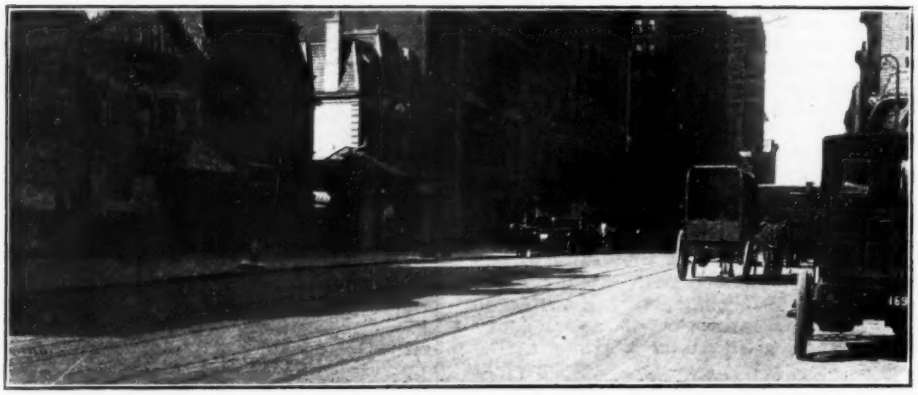
Cushion—One inch of sand.

Joint Filler—Sand.

Following is a tabulation giving lengths and areas of streets in the borough of Manhattan paved with creosoted wood blocks up to and including close of our 1912 contracts:

NAMES, LENGTHS AND SQUARE YARDS OF STREETS AND AVENUES IN THE BOROUGH OF MANHATTAN PAVED WITH CREOSOTED WOOD BLOCK.

Locations.	Length in feet.	Area square yards.
Avenue A, Houston to Twenty-fourth	6,239	22,982
Albany street, Washington to West	198	602
Avenue B, Houston to Fourteenth	3,436	6,479
Battery place, Broadway to West	670	8,200
Barclay street, Broadway to West	1,439	5,272
Bedford street, Houston to Grove	1,286	2,835
Beekman street, Nassau to Park Row	219	650
Bond street, Bowery to Broadway	1,024	4,200
Bowling Green, Whitehall to State	196	1,134
Bridge street, Whitehall to State	290	744
Broadway, Battery place to Vesey	3,083	15,291
Broome street, Centre to Broadway	313	925
Cannon street, Rivington to Houston	814	2,287
Carlisle street, Washington to West	198	338
Avenue C, Houston to Twelfth	2,821	7,880
Cedar street, 150 feet east of William to Pearl	357	754
Chambers street, Broadway to West	1,818	6,904
Church street, Liberty to Cortlandt	344	1,021
Church street, Cortlandt to Day	227	1,100
Church street, intersection Day street	50	146



CREOSOTED WOOD BLOCK *paving on a New York heavy traffic business street with double car tracks.*

Church street, Day to Fulton	170	830
Church street, Fulton to Vesey	186	323
Church street, Vesey to Duane	1,793	3,949
Cleveland place, Broome to Sprin	528	1.498
Clinton street, South to East Broadway	1,235	3,817
Cortlandt street, Broadway to West	1,117	3,744
Delancey street, East to 112¼ feet east of Ridge	2,405	7,567
Delancey street, 68 ft. east of Essex to 84 ft. west of Christie	1,715	13,109
Delancey street, 83 ft. west of Christie to Bowery	185	1,467
Dey street, Greenwich to West	386	2,371
Duane street, Broadway to West	2,076	7,648
E. Broadway, Scammel to Gouverneur	276	1,135
E. Broadway, Chatham square to Grand	4,162	19,379
First avenue, 25th to 26th, and 28th to 29th	480	3,000
Fourt hstreet, Macdougal to Sixth ave	393	1,173
Fortieth street, 8th avenue to 10th avenue	1,746	5,899
Gt. Jones street, Bowery to Broadway	823	3,594
Greenwich street, Battery place to Dey	2,682	9,861
Greenwich street, Vesey to Chambers	1,273	4,571
Greenwich avenue, Bank to 8th avenue	940	3,582
Horatio street, Greenwich ave. to 8th ave	220	738
Houston street, Eldridge to Bowery	902	2,397
Hudson street, Jay to Worth	201	1,060
Houston street, Macdougal to Bedford	432	2,496
Jay street, Hudson to Staple	150	535
Jefferson street, E. Broadway to Henry	189	627
John street, Nassau to Broadway	359	888
Kenmare street (Delancey), Bowery to Lafayette	917	4,282
Lafayette street, 139 feet near Spring	274	1,460
Lewis street, Grand to Delancey	666	1,897
Liberty street, Broadway to West	1,031	3,046
Murray street, Broadway to West	1,623	6,176
Norfolk street, Hester to Houston	2,202	6,088
98th street, Central Park w. to Amsterdam ave	1,649	5,521
Old Slip, Water to Front	370	1,356
111th street, 5th avenue to Lenox	944	3,146
Park place, Broadway to West	1,541	6,499
Pitt street, Broome to Houston	1,627	4,409
Prince street, Broadway to Wooster	616	1,769
Reade street, Centre to West	2,494	8,802
Sheriff street, Broome to Houston	1,626	4,645
Spring street, Broadway to Sullivan	1,274	3,768
Staple street, Jay to Harrison	212	370
State street, Bowling Green to Whitehall	1,169	6,533
Stone street, Mill Lane to William	118	203
Sullivan st., Canal to Washington Sq. S	3,702	9,978

River Road, West Lafayette, Indiana. Constructed with "Tarvia X" Photographed two months after the flood.

This road was 10 feet under water

The roadway illustrated above runs along the banks of the Wabash River at West Lafayette, Indiana.

In March, 1913, the great floods raised the river to the white mark on the tree at the left of the picture, completely submerging the macadam roadway.

This stretch of road was constructed in 1911 with "Tarvia X," and the condition of the highway after the flood gives ample demonstration of the fact that a Tarvia-bonded roadway is waterproof.

Tarviated macadam sheds an ordinary rainstorm immediately. Water does not percolate into the surface or loosen the Tarvia bond.

In this instance, the road got more than an ordinary wetting, but after the waters receded the macadam was found still in excellent condition, unchanged in contour, and ready for traffic without any attention or repairs.

"Tarvia X" is a dense, viscid, coal tar compound of great adhesive power and immune from damage by water or weather. Used as a binder, it so increases the strength of the macadam as to make it automobile-proof and erosion-proof. The saving in maintenance expense and the prolongation of the life of the road more than balance the cost of the Tarvia treatment.

Booklets on Request.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland
Cincinnati Minneapolis Pittsburgh Seattle Birmingham
The Paterson Mfg. Co., Ltd.—Montreal Toronto, Winnipeg, Vancouver, St. John, Halifax, Sydney, N. S.

2d avenue, 23d to 37th, and 48th to 53d	5,155	25,090
2d avenue, intersection of 26th	77	342
2d avenue, 74th to 83d	2,491	12,246
Trinity place, Morris to Liberty	1,419	6,985
19th street, Hudson to West	955	2,659
13th street, 8th avenue to 10th avenue	1,698	6,001
12th street, Broadway to 5th avenue	972	3, 49
20th street, Broadway to 5th avenue	298	988
22d street, 6th avenue to 10th avenue	3,318	10,957
23d street, 2d avenue to 10th avenue	6,474	25,191
23d street, 10th avenue to 11th avenue	636	2,279
34th street, Madison ave. to 8th ave	3,066	12,854
Vesey street, Broadway to West	1,386	2,934
Warren street, Broadway to Greenwich	1,245	4,742
Washington Sq., S., Wash. Sq. E. to Wash.Sq. W	1,071	3,295
Washington street, Carlisle to Albany	232	638
W. Broadway, Dey to 4th	8,425	28,746
Water street, Montgomery to Scammel	524	1,482
Whitehall street, Bowling Green to S. Ferry	1,308	10,093
Worth street, Broadway to Church	492	1,644
2d avenue, 13th to 15th	578	2,670
2d avenue, 17th to 19th	568	3,380
18th street, Broadway to 6th avenue	1,377	4,630
28th street, 5th avenue to 9th avenue	1,676	5,490
Houston st., Lewis to Norfolk, and Manhattan st., Houston to 3d	2,893	11,730
Broadway, Columbus Circle to 78th	5,600	40,530
6th avenue, 42d to Central Park S	4,760	22,780
Hudson street, Barrow to Christopher	481	1,890
Clarkson street, Varick to Hudson	408	1,670
1st avenue, 26th street to 28th street	618	3,380
3d avenue, 116th street to 125th street	2,392	15,050
10th avenue, 50th street to 51st street	221	1,250
Houston street, Varick to Hudson	408	1,550
Pearl street, Broad to Whitehall	365	1,100
Stone street, Broad to Whitehall	401	1,040
Water street, Wall to Maiden Lane	487	1,300
Exchange place, Hanover to New	782	1,730
Washington place, Dey to Albany	906	2,430
Washington st., Battery place to Albany	1,546	4,130
2d avenue, 5th to 7th	496	2,425
Totals	144,308	569,520

A Motor Truck Hauling a Canal Boat

The successful use of a motor truck in hauling canal boats is shown in the accompanying photograph of a LaFrance gasoline hydraulic truck hauling three canal barges at Schenectady, N. Y. The truck has 48 horsepower. The maximum draw-bar pull is 10,000 pounds, and it can develop this pull at any speed from zero up to 2 miles per hour.

This new application of the motor truck, heretofore impossible under the former methods of power transmission, was considered of sufficient interest for Pathe Freres to include it in their weekly record of the most interesting events in the world, shown in the moving picture theaters to over twenty million people.

Regarding the actual experiment made at Schenectady the truck itself was not loaded and therefore, not having traction, it was not possible to get the maximum tractive effort or draw-bar pull, that developed being 4,000 pounds or less.

The photograph shows the truck towing the three canal boats, and it was estimated that the speed was in the neighborhood of four miles per hour. A few hours later, after the camera man had gone home and after the crowd had left, two more boats came along and were hooked on. The truck towed the five boats at a speed of three miles per hour, measured by quarter-mile posts.

The total gross weight of the first three boats was 731 tons and the total gross weight of the five boats was 1,250 tons. From the figures of the experiments it is clearly shown that the truck properly constructed and properly weighted down for traction, will be able to tow from ten to fifteen canal boats at a speed of two to three miles per hour. Three mules will tow two boats at a speed of one and

LINK-BELT

Loading and Unloading Machinery

Cuts down the costs of Making Good Roads

PORTABLE WAGON LOADER

Further information in Bulletins Nos. 170 and 188, sent on request.

The Link-Belt Portable Wagon Loader

Loads 40 Yards an hour Does the Work of 10 Men

HANDLING sand and gravel in the old hand-shovel way is hard work and expensive. The problem of applying machinery successfully to this class of work has been solved by the construction of the Link-Belt Portable Wagon Loader, in which a steel frame-work, mounted on wheels, supports a strong bucket elevator in such a manner that the foot of the elevator can be pushed right into the base of a pile of material, and the head arranged with suitable discharge spout to deliver material directly into wagons or trucks; or into a screen for separation of sizes before delivery into the wagon, if desired.

The elevator is driven by a 5 H. P. motor, electric or gasoline as required, mounted on the same general frame-work, and the size of buckets and continuous operation furnish a capacity of 60 tons of coal, or 40 yards of broken stone per hour, thus enabling a crew of two or three men to do work which would require at least ten men with shovels. A clear saving of five to ten cents per ton can easily be made in handling materials in any large quantities.

The Link-Belt Gondola Car Unloader

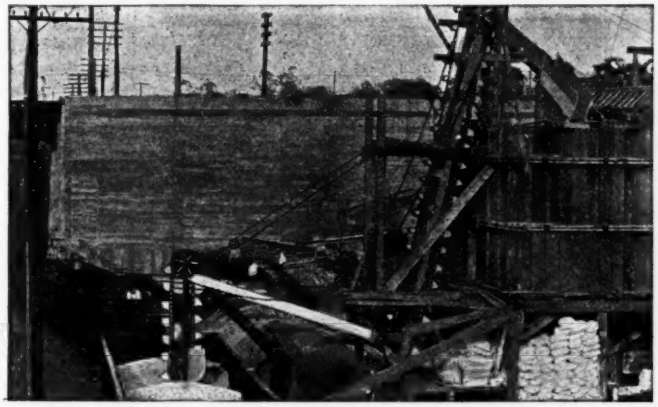
(Built Either Movable or Stationary)

A successful application of machinery for unloading Sand, Stone, Gravel, Coal, Etc.

With this simple outfit two or three men can unload a car of material at the rate of 50 tons an hour.

A comparison of the cost of unloading by this method and the old-fashioned way of using eight or ten shovelers in the car, throwing over the side, will illustrate clearly the value of the unloader, where any quantity of cars must be unloaded in a day.

Unloading cars with hand labor costs from 8 to 10 cents per ton. The Link-Belt Unloader will not only do this same work more rapidly, but in actual operation it has reduced the labor cost to about 1½ cents per ton.



STATIONARY TYPE LINK-BELT CAR UNLOADER

With two men trimming to the foot of the bucket elevator in the car, this outfit replaced six shovelers formerly required to unload the material.

The machinery consists of a heavy elevator on a steel frame, hung on the end of a boom, which may be lowered and raised in and out of the car by means of a wire rope and winch. The material, fed to the buckets by shovelers in the car, is delivered by means of a steel spout to a second fixed elevator which fills the bin. The distinct advantage of using two elevators is, first, it decreases the weight of the hinged part, and second, the material may be spread on the ground at each side of the pocket as a reserve storage, if possible.

Link-Belt Car Unloading Outfits are simple in construction and low in first cost and operating expense. Contractors, especially, will readily see the large savings in the time and expense to be made by their use.

Price, blueprints and all necessary information will be mailed upon request.

LINK-BELT COMPANY,
Nicetown, Philadelphia, Pa.

Without obligation, you may send us booklets and information regarding the Link-Belt Wagon Loader / Unloader

We handle about _____ tons of _____ a day.

(Name) _____

(Address) _____

(Town and State) _____

a half miles per hour and never in excess of two miles per hour. The truck will handle about as many tons per day as could be handled by fifty mules. It must be remembered also that the boats have to carry extra mules with them in order that a shift of mules may work half the time and rest half the time. Using automobile trucks for this work would enable the boats to utilize the space which is now being given to the housing of the mules.

The ordinary gear-driven truck cannot develop its maximum horsepower unless its motor is running at full speed. This means that the ordinary gear-driven truck cannot develop its maximum draw-bar pull unless it is running at whatever speed the low gear gives when the engine is running at its maximum. Therefore if an ordinary truck were used towing canal boats it would be unable to start the boats because the jerk would either break the tow rope or stall the engine of the truck.

MOTOR TRUCK *hauling three canal boats on Erie canal at Schenectady, N. Y.*

The truck used has a hydraulic transmission, which can develop its maximum draw-bar pull of 10,000 pounds at any speed up to two miles per hour. At three miles per hour it will develop a draw-bar pull of 7,500 pounds. The tow-rope pull necessary to haul canal boats at a speed of four miles per hour can be determined very approximately by the following formula:

The gross weight of the boat in tons, multiplied by the square of the speed in miles per hour, multiplied by a constant varying from 0.45 for loaded boats to 0.67 for empty boats.

Waterproofing Hand Book

The Trussed Concrete Steel Company, Detroit, Mich., have just issued a waterproofing hand book containing a large amount of scientific information appearing for the first time.

The Trus-Con Hand Book clearly differentiates between methods of waterproofing and dampproofing, showing the best methods of treatment for specific conditions. Integral waterproofing is covered fully with numerous specifications and directions, explaining clearly how mass concrete can be absolutely waterproofed.

The various methods of dampproofing exposed surfaces of concrete, stucco, brick and masonry are discussed, and various products are indicated to insure the most satisfactory results. The troublesome problem of treating concrete floors which have become dusty is brought up, and the remedy is suggested. Sanitary, washable interior finishes are indicated, both for residential and business buildings. The protection of structural steel is scientifically treated and materials are indicated to provide against various exposures.

A copy of the Trus-Con Waterproofing Hand Book will be forwarded by the Trus-Con Laboratories to those who indicate their business or professional connection.

The Blue Print Department

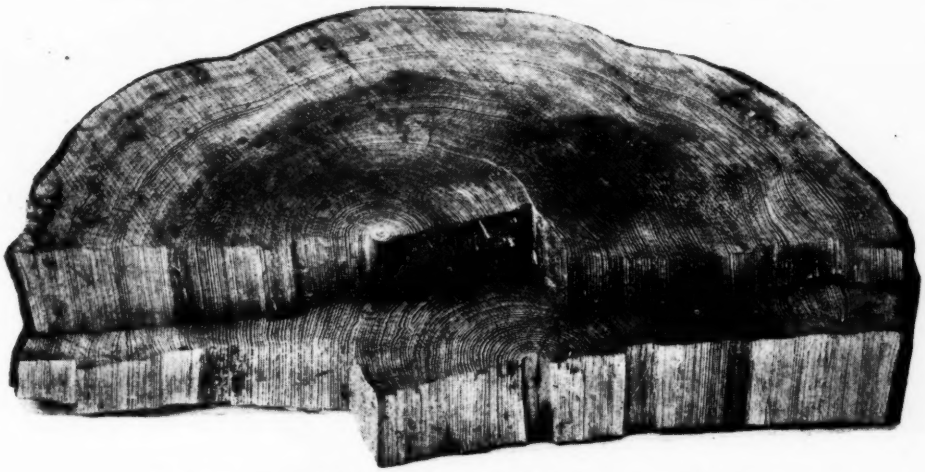
By Ralph W. Davis, Chief Draftsman, Cadillac Motor Car Co., Detroit, Mich.

One of the most important differences between an automobile factory and the usual manufacturing plant is that the automobile work must be produced at a high speed. This requires that, from the time the first ideas are conceived until the car is in the factory under production, every one must work at high tension. Especially is this true of the drafting and designing departments, and inasmuch as the blue print department is an essential part of the drafting room it becomes absolutely necessary that blue prints be made and delivered promptly and surely to all departments requiring same. In meeting

SOUTHERN YELLOW PINE

THE BEST WOOD FOR CREOSOTED PAVING BLOCKS

OWING TO ITS EXTRAORDINARY PHYSICAL CHARACTERISTICS.



Close Annular Rings, Dense, Hard, Strong and Durable.

Mr. H. W. Durham, Chief Engineer in Charge of Highways, Borough of Manhattan, City of New York, states:

> "Our specifications provide that the wood to be used shall be ***Southern Long Leaf Yellow Pine.*** * * * That the popularity of 'Creosoted Wood Blocks' as a paving material is illustrated by its present use—320,000 square yards having been awarded in the City of New York during 1912. * * * Very little trouble and few repairs has resulted when the material has been ***Yellow Pine,*** and the absorption test has been maintained."

The facts are, *Southern Yellow Pine* has made "Creosoted Blocks" a popular paving material, owing to its *great strength under end compression, dense, hard texture and uniform straight grain.* The resin this wood contains is a preservation in itself, so that Yellow Pine blocks, when properly creosoted, will insure absolute paving satisfaction for *years* in the most trying, congested traffic districts of our largest cities, namely, New York, Boston, Chicago, St. Louis, Atlanta, Cincinnati, Detroit, Louisville, Memphis, etc.

Mr. ENGINEER: Hereafter be explicit. ***Specify "Southern Yellow Pine"*** for your next creosoted paving block contract. It makes an ***economical*** and ***desirable street pavement from every standpoint*** and gives ***longer*** and ***more efficient service*** for the money expended than any other pavement known to engineers.

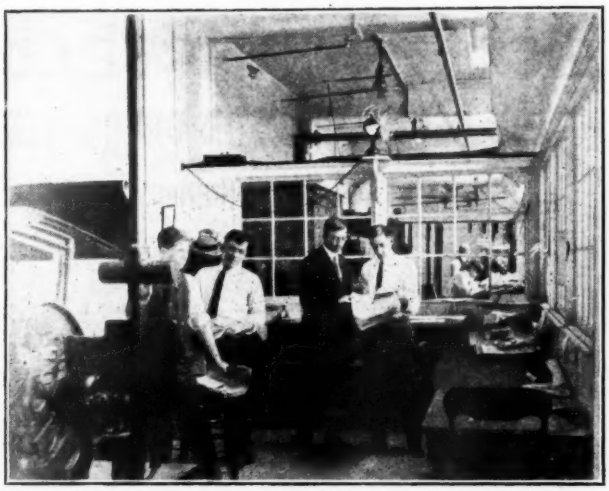
No royalties paid for its use, and no large repair appropriations necessary.

WRITE FOR LITERATURE AND INFORMATION.

Yellow Pine Manufacturers' Association, 711 Wright Building ST. LOUIS, MO.

this condition in the Cadillac Motor Car Company we have adopted the machinery and method which are about to be described.

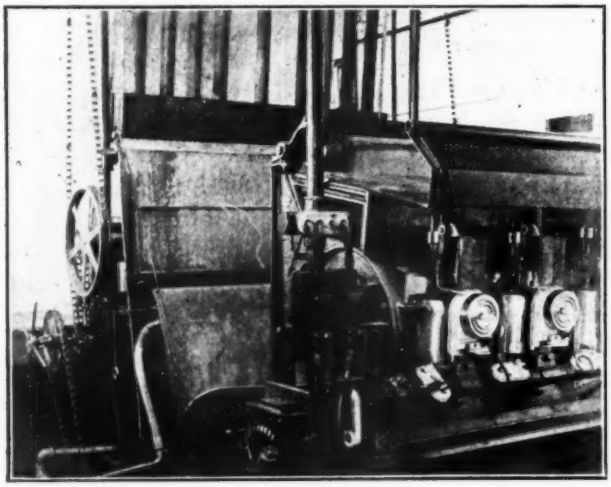
In our tool factory our tool drawings are made so that blue prints are furnished to the factory for the tools instead of the pencil drawings which are furnished to the tool room in many plants. This, of course, adds to the volume of work which must pass thru the blue print room. Our tools are all drawn up on bond paper, so that in printing these the machine must be run at a different speed than we would run it for the tracings. All our car parts are made on the regular tracing cloth.



BLUE PRINT ROOM *of the Cadillac Motor Car Co., Detroit, Mich.*

Our blue print machinery consists of a Pease continuous print blue print machine with six powerful arc lights and capable of taking paper about 50 inches wide. Connected to this machine by suitable gearing we have an automatic washer and drier so that as the prints come thru they are dried and ready for use as fast as they can be cut down.

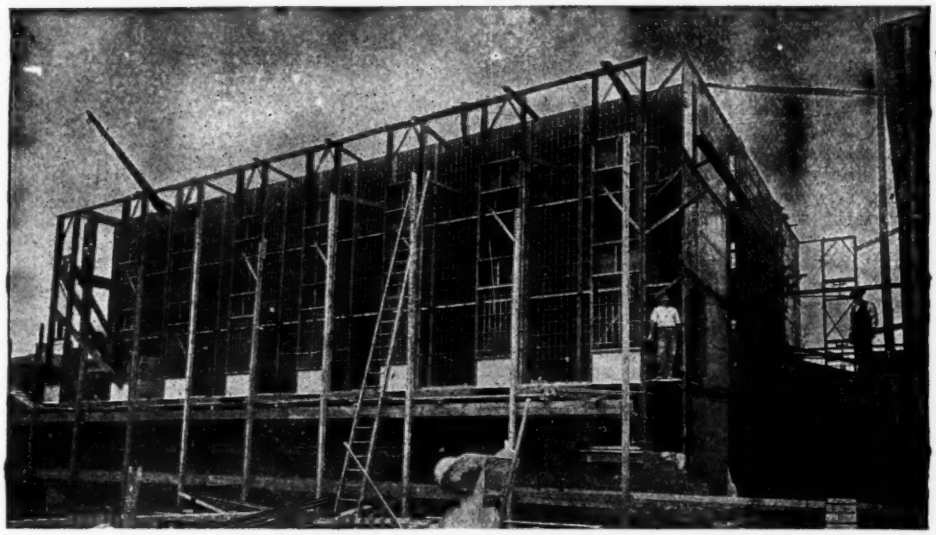
Prints are ordered by requisition forms. On reaching the chief draftsman's clerk, a triplicate copy is made, one sheet being white, one blue and one red. These, with the requisition, are sent to tracing vault clerk, who gets out the tracing and places the white copy of order in file and passes remainder to blue print room. After prints are made, they go to sorting table, where the original requisition and the red copy are pinned to the print, the blue copy being filed in blue print room files. The prints are rolled up and secured by adhesive paper tape, and delivered by messenger to proper departments. (We formerly used rubber bands for holding prints in roll, but the tape is more effectual and much more economical.) On reaching the party who ordered the print, he signs the red slip and mails same to blue print room, this becoming the recognized receipt for prints. Thus we can follow an order and locate any delays or holdups and each person has an automatic record. In case a tracing is being changed, that fact is noted on original requisition and returned to person ordering. This feature enables us to run our prints at certain definite periods of the day, and thereby facilitate the getting out of work and making the deliveries on specified schedule. Of course for emergency work prints can be put thru in the regular way and washed and dried by hand.



BLUE PRINT MACHINE *showing controlling switches and gearing for washer.*

The accompanying photographs 1 and 2 show the machine and arrangement of the blue print room. Fig. 1 shows the left

V=A=N=D=O=R=N



View of Cage containing 120 steel cells at the Hartford County Jail, Hartford, Conn. Erected by us before carrying up outside masonry walls.

WHITE DIAMOND TOOL PROOF

Celebrated Steel Cells

For Prisons, Police Stations and Lockups

We are sole manufacturers ot the Van Dorn White Diamond Material, manufactured by a special process and offered by no other company. By this process our Burglar-proof work is made with an exterior coat of steel uniform in thickness and hardness, absolutely saw, file and drill proof, the core or center part being soft iron. Over 25,000 cells now in use have withstood prisoners of all grades, and the Van Dorn Jail is being known as the safest and most secure jail in existence.

Make Sure You Specify Van Dorn White Diamond Burglar-proof Material

A few of the many jail contracts awarded to us are as follows:

Baltimore, Md. (States Prison) 846 Cells
New York City (Tombs Prison) 352 Cells
Lincoln, Neb. (States Prison) 156 Cells
Moundsville, W. Va. (States Prison) 360 Cells
Boston (Deer Is. Reformatory) 360 Cells
Washington, Wash'ton Co., Pa. 116 Cells
Long Island City, Queens Co., N.Y. 224 Cells
Pittsburgh, Pa. 200 Cells
Cleveland, Ohio, 250 Cells
Hartford, Hartford Co., Conn. 118 Cells
Buffalo, Erie Co., N. Y. 300 Cells
Rochester, Monroe Co., N.Y. 250 Cells
Harrisburg, Dauphin Co., Pa. 140 Cells
Boston, U. S. N. Prison 150 Cells
Wethersfield, Conn. (States Prison) 187 Cells

THE VAN DORN IRON WORKS CO.
PRISON CONSTRUCTION DEPARTMENT
CLEVELAND, O.

hand end of the machine with its controlling switches and the gearing for the washer. For those who are not familiar with this washer, I would point out that the pipes at the upper part of the picture are covered with gauze mesh and that the gas jet under these produces a heat for drying the paper as it runs up over a roll at the top of these pipes. We also have a large tank at the end of the room filled with a potash solution for use on prints which are run thru in small orders, with a small hand washing machine at the right in which the potash is washed off.

Fig. 2 is a view looking at the remainder of the room, and in the distance beyond the partition is found our filing vault. Both of these rooms are under the supervision of the blue print foreman, who is thus responsible for tracings at all times after they leave the drafting room. The drafting room itself is just outside of the long partition at the right of the photograph, and is separated only by means of these glass partitions.

For ventilation purposes we have a large pipe and blower which removes all burnt gas and other odors from the room.

The average force in this blue print room consists of the foreman and three men. The amount of work that they produced in a given period will be of considerable interest.

Since January 1, 1913, up to May 31, we used 16,625 yards of paper, making a total of 73,031 blue prints. The machine was in operation in this period for 303 hours. The standard paper used is 36 inches wide, and on a basis as above, and allowing for depreciation and overhead, we find that it costs us about approximately 8 cents per running yard.

A record is kept of the daily work done in the blue print room, and in the accompanying table will be found the reports from the blue print department for the weeks ending at the dates given and will show the variation in work for various weeks. This variation is, of course, due to the necessity for getting out complete sets of prints for one department or another, or other work of this character, which renders it impossible to predict any given amount of work for any given week, but we have followed this method of keeping records for several years, and are able to estimate very closely on the amount of paper which will be required during the year, and thus get prices in accordance.

The necessity for keeping up-to-date prints thruout the entire plant is, of course, important, and employing as we do, some 7,000 men in the Cadillac factory, requires that the blue print department be eternally on the look-out for any out-of-date prints, and to be sure that the up-to-date prints are in the hands of the proper persons, so that a blue print department forms a very important adjunct to the up-to-date factory and drafting room department.

WEEKLY OUTPUT OF BLUE PRINTS.

Week ending 1913		Hours per Week of machine operator	Total prints per week
Jan.	4	17	3,860
	11	13½	2,610
	18	11	2,405
	25	22½	5,727
Feb.	1	11¾	2,518
	8	11½	2,550
	15	18¾	4,701
	22	18	5,121
Mar.	1	11	2,364
	8	6¾	1,550
	15	19	4,699
	22	10¼	2,594
	29	14¼	3,066
Apr.	5	19	5,511
	12	16	3,329
	19	12¾	2,892
	26	15	3,739
May	3	16	3,836
	10	22½	8,77-

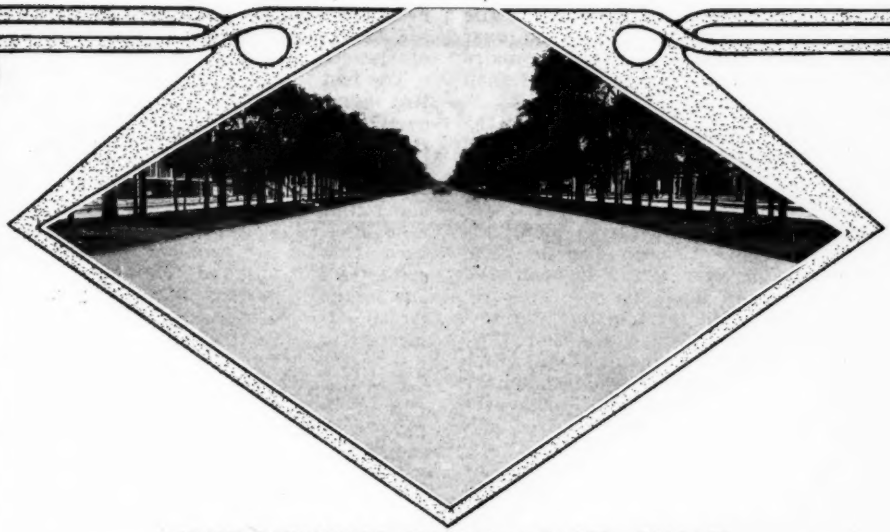
Economy of Operation of Motor Fire Apparatus

By A. V. Bennett, Chief of Fire Department, Birmingham, Alabama.

The cost of operating motor fire apparatus is rather difficult to determine accurately as yet, because of the uncertainty of depreciation and necessary repairs due to actual wear and tear. The expense of operation, however, is largely controlled by the ability and care of the driver in the handling of your machine, who will raise the cost to abnormal proportions, or lower it decidedly below that of the horse-drawn machine doing the same work, proportionately as he exercises skill and judgment in his driving.

Tire equipment will necessarily be one of the factors in the cost of operation. The pneumatic tire possesses many advantages, such as resiliency and traction, is less liable to skid and protects the machines against rough driving, but the ever present danger of a puncture of blowout, often putting the machine out of commisison to change or repair tires, and the expense of frequent replacements renders the pneumatic far from being the ideal tire.

The solid tire too has its advantages and disadvantages. The danger of punctures and blow-outs is entirely eliminated, and this equipment is durable and thoroly reliable. With dual tires on the rear wheels, sufficient traction is obtained to carry the machine where you might reasonably expect to go, but the vibration to



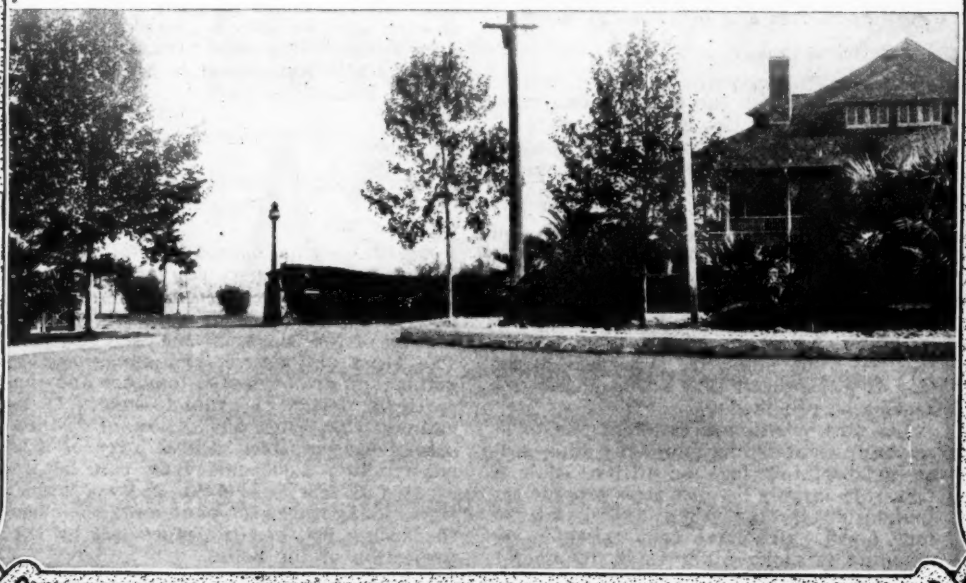
GRAND BOULEVARD CHICAGO—44-45th STS., CHICAGO,
Paved with Sarcolithic Mineral Rubber, ¾-inch Thick, in May, 1908. No repairs necessary to date.
(Photograph token July, 1912.)

SARCO PAVING ASPHALTS

make superior street pavements that are extremely durable, positively noiseless, perfectly sanitary and entirely proof against water action. Write for specifications and testimonials.

STANDARD ASPHALT AND RUBBER COMPANY
137 S. La Salle St. CHICAGO.

SARCOLITHIC MINERAL RUBBER PAVEMENT
City Park Avenue, New Orleans, La.



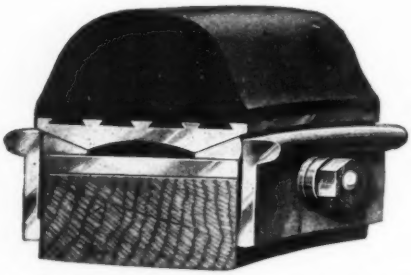
which your machine is subjected while being rapidly driven, especially over rough streets, necessitates many repairs and sooner or later the car to the shop for a general over-hauling.

The cushion tire combines many of the good qualities of both the pneumatic and the solid, but does not possess the durability of the latter, and is correspondingly more expensive.

The actual cost of operating motor apparatus, exclusive of wear and tear and depreciation, is very small as compared with horse-drawn machines.

We have cars in service that the cost of operation has averaged less than $3.00 per month since their installation, which was nearly 3 years ago. We also have machines in service, which during the last 18 months have not required one penny's worth of repairs.

The demountable feature is one of the most valuable of all fire truck tire improvements as it abolishes the need of a tire-applying station and effects a big time, trouble and expense saving to the



GOODYEAR *demountable dual tire for fire apparatus and other heavy work.*

department. With the demountable tires on fire apparatus, tire breakdowns are almost eliminated. If you wish to replace a tire, instead of removing the wheel and sending it away, one of your men simply jacks up the wheels, unbolts the side flange, slips off the rings and wedges and off comes the tire. A jack, chisel and wrench are all that are needed, and the job is done quickly and the truck hasn't been out of commission one moment.

If the fullest possibilities are to be realized from motor fire apparatus operation it is essential that an economic tire service be provided.

The tire question is the final one to be solved in establishing motor fire apparatus as an absolutely feasible utility. This is true very largely because tires provide the foundation for the truck, and no matter how much pains have been taken in developing it along other lines, its usefulness does not become apparent until it has been provided with a good and thoroly practical foundation.

The last few months have seen the solid tire industry making greater strides than ever before in history. The best proof of this is the fact that mileage guarantees have been increased 2,000 and in some instances 4,000 miles, and, whereas, up to a short time ago mileage guarantees varied according to location in which tires were used, this is no longer the case. Most solid tires of standard make at the present are covered by a universal guarantee irrespective of road conditions or other matters peculiar to certain localities.

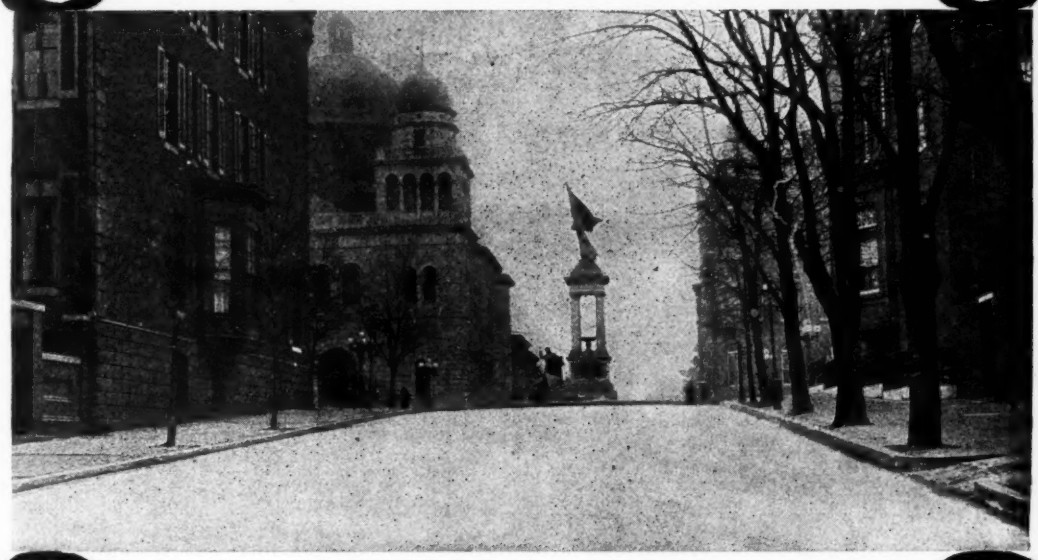
Pavements of Rome, N. Y.

Rome is a small city in central New York which has done much in the way of improvement of streets not alone with pavements, but also with flag and cement sidewalks and beautiful elm and maple shade trees. The city has 13.357 miles of streets. Of these 4 streets are paved with brick, in all 3.087 miles; 9 with asphalt, in all 4.92 miles; and 18 with bitulithic, in all 5.35 miles. The first bitulithic street was laid about nine years ago, and since that time nothing else has been laid, the property owners always petitioning for it. The manufacturing interests along the railroad in East Rome donated a street to the city this year, paving it at their own expense with bitulithic without asking for bids. A wide space was left between curb and buildings and permission will be asked of the New York Central railroad to grade the other side so as to give a strip of grass on each side of the street, enough to make a very respectable little park. About two miles of bitulithic street in all have been laid in Rome this year.

Levee Reinforced with Virtified Pipe

An interesting suggestion for the use of large size vitrified sewer pipe as reinforcement for strengthening and raising levees and dams is made in the new catalog of the Blackmer & Post Company. The pipes are set vertical and close together and are cemented together and the earth is deposited around them. It is claimed that with 250 pieces of 36-inch second-class pipe on hand a levee of this construction 1,000 feet long can be increased 3 feet in height in two hours' time, using sacks of sand only to close the spaces between the pipes left by the projection of the bells.

TWO MONUMENTS



The Mounment in the background is that of Francis Scott Key, author of "The Star Spangled Banner."

In the foreground the ***pavement*** is a monument to the contractor who laid it. That contractor's well-deserved fame is built upon the judgment that employed

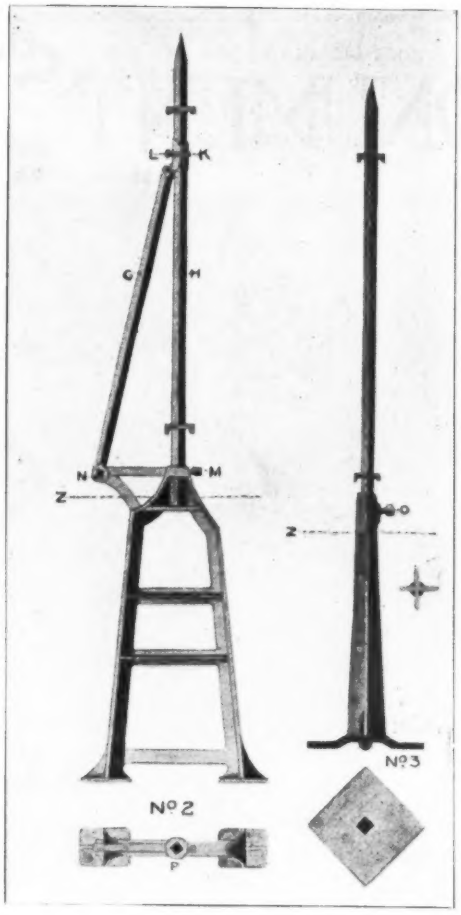
AZTEC ASPHALT

which possess in greater degree than any other asphalt these elements:— **cementing quality, ductility, low susceptibility to temperature changes.**

You, too, may build so that "by their works ye shall know them" will have a proud significance for *you.*

The United States Asphalt Refining Co.

90 West Street NEW YORK.



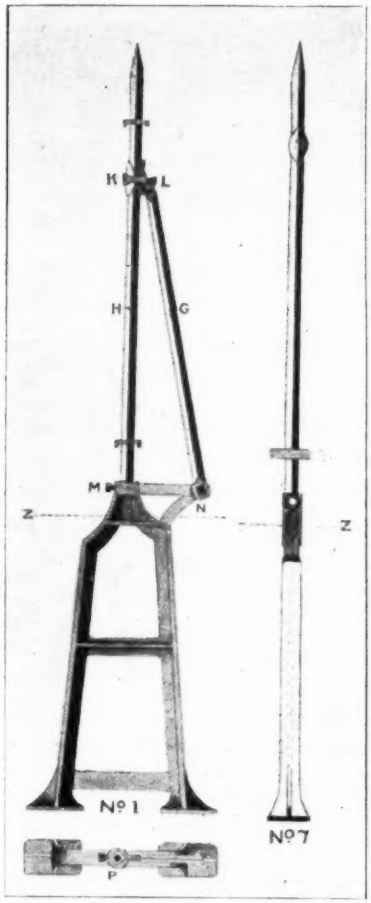
FOUNDATION POSTS *for Van Dorn system of iron fence construction.*

Iron Fence Construction

The illustrations on this page show construction of Van Dorn fencing, which is built in sections not exceeding 8 feet in length, the standard centers for pickets being 5 inches for ¾-inch square, and 4 inches for 9/16-inch square pickets. The holes are punched in the rail square with the rail. The corners of the picket are reduced to the size of the square hole, the picket passes thru the hole to the notch, and is then given a quarter turn, bringing the corners of the picket diagonally across hole. The notch being shorter than thickness of rail grips the top and bottom surface of rail, thus interlocking the picket and rail. The dog is then driven down, forcing the legs of dog into the spaces at side of picket, the legs of dog being clinched under the rail, thus securing a joint that is solid and immovable, and rendering the sections rigid and strong. This locked joint is used on all Van Dorn regular gates and open posts.

Foundation illustration No. 2 represents a typical cast iron foundation for heavy fence. These foundations are placed under the ends of the sections and extended in the ground to dotted line Z Z, forming a solid brace upon which fence is supported. The bottom of brace post H extends into the sockets of foundation and is held in place by steel set screw M. Brace G is attached to the extended arm of foundation with bolt N, and attached to the brace post by the adjustable sleeve K. This sleeve is made of malleable iron, is cored to proper size to admit brace post H and held securely in place by steel set screw L.

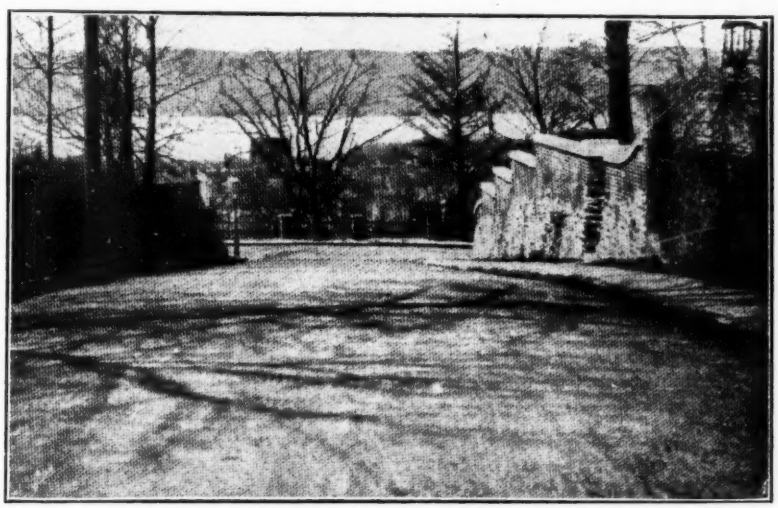
Foundation illustration No. 3 illustrates



LIGHT POSTS *are designed for the smaller fences.*

THE PAVEMENT OF QUALITY is the Bitulithic

The pavement made of varying sizes of the best stone obtainable and bituminous cement, having the density and inherent stability a successful standard pavement must have.



BITULITHIC PAVEMENT.—Undercliffe Street, from Alta Avenue, Yonkers, N. Y., looking toward Hudson River, showing 13 per cent grade, pavement laid 1902. Photograph taken March 30, 1912.

The growth of the **Bitulithic** from 16,400 square yards in 1901 to the extent of over 29,600,000 square yards in over 296 cities throughout the United States and Canada, which is equivalent to over 1,685 miles of roadway 30 feet wide between curbs, demonstrates its popularity.

Bitulithic is the answer to the question of economy in street paving.

If **Bitulithic** is once adopted for your streets you will always insist on it. Additional large contracts are constantly being awarded by cities that have used it for many years.

If your streets are paved with **Bitulithic** the attractiveness of your city to visitors as a place of residence will be increased and directly result in a growth of population.

Automobilists constantly traveling over the **Bitulithic** streets carry its praise everywhere.

Is not the experience of over 296 cities enough to satisfy you that **Bitulithic** is the "Best by every Test?"

Bitulithic is a pavement built up to a high standard and not down to a low cost. Do not wait until a mistake is made by experiments. Pave your streets with **Bitulithic** and avoid mistakes.

Bitulithic appeals alike to city officials and property owners and automobile drivers.

Bitulithic is a sanitary, dustless, non-skidding pavement, and affords a secure foothold for horses.

Write today for illustrated booklets and learn more about this modern, ideal street pavement for modern cities.

Warren Brothers Company

EXECUTIVE OFFICES:

59 Temple Place, BOSTON, MASS.

DISTRICT OFFICES:

NEW YORK, N. Y.	CHICAGO, ILL.	ROCHESTER, N. Y.	LOS ANGELES, CAL.	PORTLAND, ORE.	PHOENIX, ARIZONA
50 Church St.	10 S. LaSalle St.	49 West Ave.	926 Calif. Bldg.	Journal Bldg.	221 Goodrich Bldg.

a cast iron support for Van Dorn heavy fence with cast plate at bottom.

Foundation illustration No. 1 is constructed same as No. 2, but is lighter and used with lighter work.

Foundation illustration No. 7 gives an edge view of both foundations, showing flanges at side and P P a top view looking down from the top, showing the sockets, flanges and base plates. All Van Dorn foundations have the same adjustable features. By this method it is possible any time to raise or lower the entire line of fence and maintain a perfect line; they are also proof against heaving by frost, which is destructive to iron fencing where it is not provided against. Upon the foundation depends the life of the fence and with this perfect adjustment no unsightly sags or crooked joints are seen, and in case of accident, it can be easily repaired and lined up as good as new.

The iron fencing above described is manufactured by the Van Dorn Iron Works Company, Cleveland, Ohio.

Development of Safety Wood Paving Block

The inventor of the safety wood block says that his attention was called to the desirability of a non-slippery wood block when the replacement of an old-style stone block pavement on State street, in Boston, by a modern creosoted wood block pavement was held up for a long time on suit of the Society for Prevention of Cruelty to Animals, alleging slipperiness on the steep grade of the street, over which a large amount of truck traffic passes.

The first blocks were laid in a stable entrance and led to the laying of a small area on Boston street. The plain piece of steel which was then used loosened to some extent and led to the design of the present form of the steel bar, which is beveled so that it locks securely into the block. The Boston street pavement was satisfactory, nevertheless, since it obviated slipperiness in icy weather, and the safety tread blocks were laid last spring on the grades on Washington street, Dorchester district. They were adopted also by the Boston Elevated Railway Company for use between rails on surface lines on grades, to sufficient extent to test them for this use.

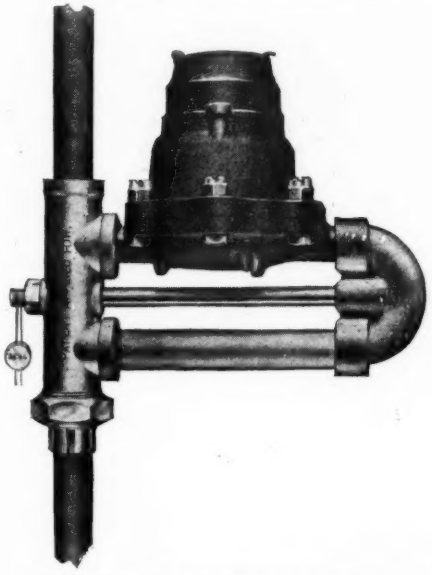
In Philadelphia the safety tread blocks have been laid on one of the piers of the Merchants and Miners Transportation Co., are under consideration for other piers, and have been specified for a small section of Vine street, giving opportunity for further test of the material. The National Safety Wood Paving Company, Real Estate Trust Building, Philadelphia, Pa., will answer any questions regarding the blocks and the methods of laying them.

Vertical Meter Connection

We are illustrating a type of sealable vertical-pipe meter connection as adopted by F. B. Wheeler, manager of the City Water Company, Chillicothe, Mo., and manufactured by the Buffalo Meter Company.

This connection consists of a galvanized iron fitting for attaching a ⅝-inch water meter in a horizontal position on either a perpendicular or a diagonal pipe, and holding both meter and pipe rigidly in place.

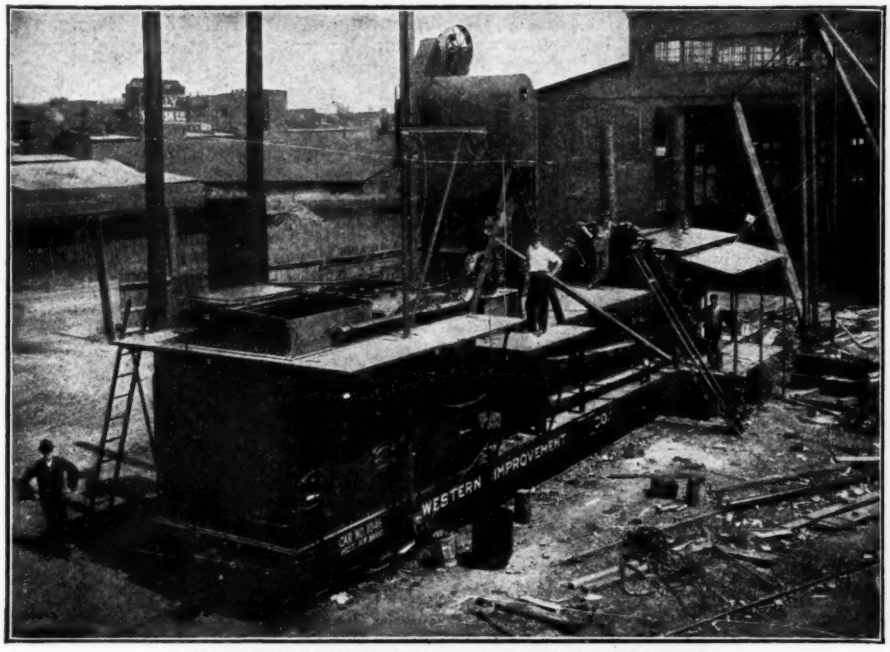
It consists of two separate parts with sockets, in which the meter is inserted



WATER METER SETTING *on a vertical pipe, designed by Buffalo Meter Co.*

and held by pressure applied thru the center rod and nut. It saves cost of brass couplings and other fittings, sets meter in the most satisfactory working position, keeps the meters interchangeable, and may be sealed. It is made in two sizes, to hold ⅝ by ½-inch meters and ⅝ by ¾-inch meters on either ½-inch or ¾-inch pipes. The indicator and indicator cap of meters set with this connection should be turned half way around to aid reading.

MODEL OF 1912 ONE-CAR PLANT.



1,000 SQUARE YARDS 2-INCH TOPPING PER DAY.

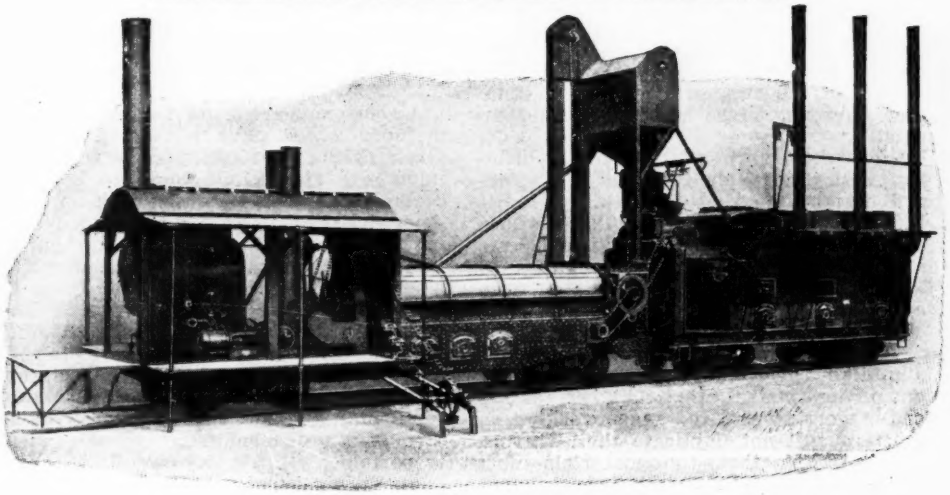
HETHERINGTON RAILWAY ASPHALT PAVING PLANTS

The product of 16 years experience in Plant Building by the originators of the first railway plant. **Still lead, are only safe railway plants made.**

THESE PLANTS HAVE NO EQUALS. WRITE FOR CIRCULARS.

HETHERINGTON & BERNER, - INDIANAPOLIS. IND.

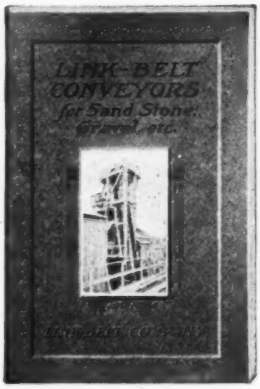
1,500 SQUARE YARDS AND 2,000 SQUARE YARDS PER DAY.



MODEL OF 1912 TWO-CAR PLANT.

Conveyors for Sand, Stone and Gravel

The Link-Belt Company, Chicago, Ill., has issued Books No. 189, devoted to conveyors, and No. 194, about the new device for unloading gondola cars. The cut shows the cover of the pamphlet and a continuous elevator handling 300 tons an hour. The illustrations in the booklet show a number of other installations of various designs and the details of chains, sprockets, buckets, carriers, screens, idlers, belts,, etc. The automatic railway, portable wagon loader, locomotive crane, car unloaders and portable asphalt paving machine are also shown. The booklet will be sent to interested contractors on request.



The Largest Street Sign Contract Ever Let in America

The city of Chicago has let a contract for about 12,000 street signs, the gross cost of which will be about $50,000. Each sign consists of two name plates, placed back to back.

A survey of the city was made and a study of the subject of signs was carried on at the same time, occupying about a year. This resulted in the changing of a number of street names, for numerous reasons, but mainly because of duplications of names.

Most of the signs are put up on ornamental wrought iron brackets attached to existing trolley or lighting poles. On boulevards and where there are no existing supports ornamental posts of a standard design like that adopted for street lighting poles will be installed. About 4,000 posts will be required. These posts are mounted on concrete foundations 18 inches in diameter and 30 inches deep and are held in place by 16-inch bolts cast in the concrete.

There is no particular engineering or administration feature in the carrying out of the contract other than the routing of the work so that the gangs working on erection will not duplicate their travels, which means that the materials must reach the places where they are needed in advance of the men, but not so far ahead as to be in danger of theft.

The contract requires about 2,000,000 pounds of metal, three large trainloads, and will be completed in about five months. The Curtis-Ward Company, 26 East Jackson street, Chicago, have the contract.

The specifications call for enameled street signs with 5 by 24-inch plates and 4-inch letters, the plates to be of No. 18 sheet metal of good English charcoal iron grade. The letters are white on a background of blue enamel. Brackets are of flat iron rod of design shown in the accompanying sketch, which shows also the method of fastening. Brackets are painted with one coat of red lead and oil and two coats of black waterproof paint.

Location of signs is determined by the location of existing poles. Where there

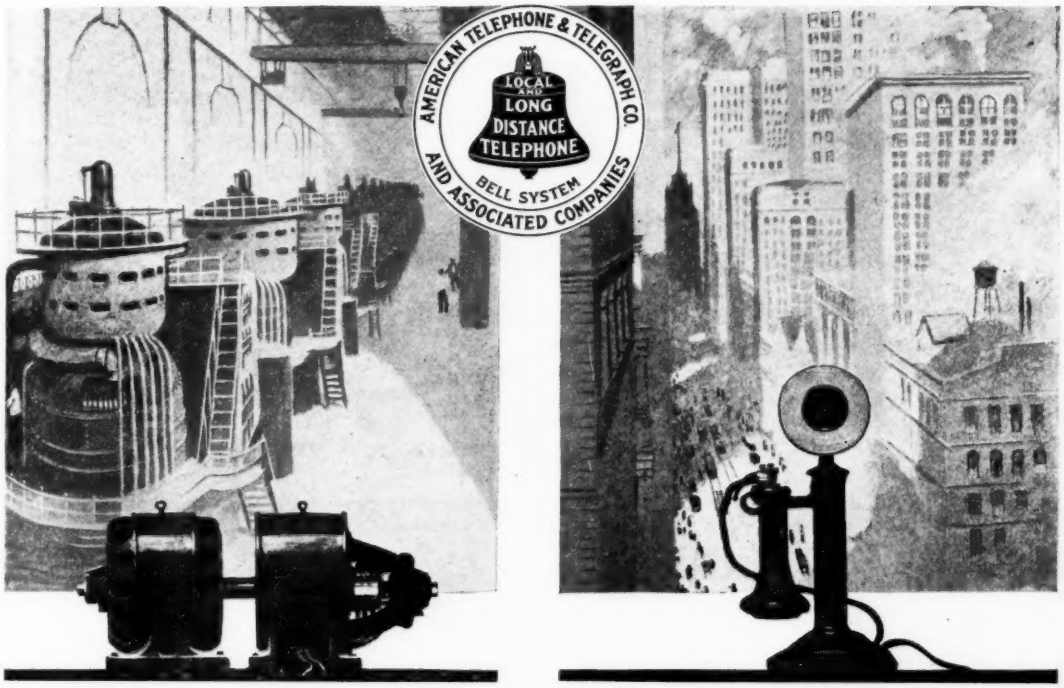
STANDARD STREET SIGN *construction on new Chicago contract.*

is a choice the corners are to be used in preference first of the northwest, second northeast, third southeast and last southwest. New posts are to be erected on the northwest corner if practicable, if not the choice is to be in the same order.

Use of Diaphragm Pumping Engines

Among improvements in construction methods which have been made within recent years perhaps none mark more important digression from the old-time methods than the substitution of the modern gasoline-driven diaphragm pumping engine in place of the hand pump. The resulting economy in time, labor and money in all cases which have come to notice has more than warranted the slight initial outlay. These gasoline pumping outfits are now perfected to such a point as to make them absolutely reliable under even the most exacting conditions and are so designed as to be a compact unit machine, easily and quickly portable.

About six months ago the street department of Middleboro, Mass., under the direction of Mr. W. H. Conner, superin-



The Energizer of Business

IN a metropolitan power-house there must be generators large enough to furnish millions of lights and provide electrical current for thousands of cars and factories.

Each monster machine with the power of tens of thousands of horses is energized by an unobtrusive little dynamo, which is technically known as an "exciter."

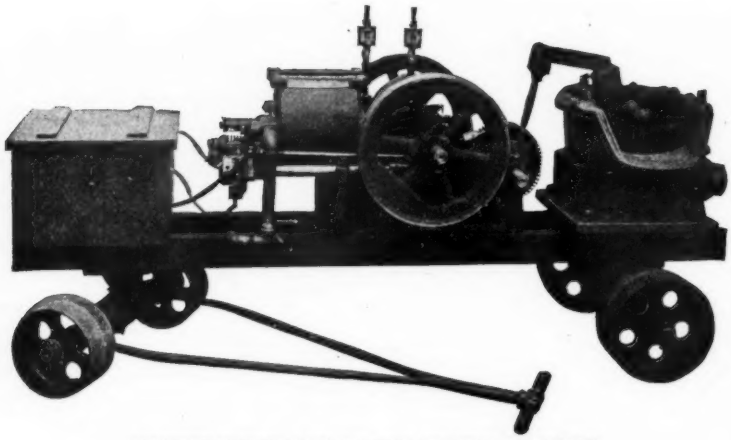
This exciter by its electric impulse through all the coils of the generator brings the whole mechanism into life and activity.

A similar service is performed for the great agencies of business and industry by the telephones of the Bell System. They carry the currents of communication everywhere to energize our intricate social and business mechanism.

United for universal service, Bell Telephones give maximum efficiency to the big generators of production and commerce.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*



THREE-INCH ATLANTIC TRENCH PUMP.

tendent of streets, replaced their hand pumps with a modern Atlantic diaphragm pumping engine, which has effected a saving over the old method of 70 per cent., and has pumped on a continuous service test as much as 50 gallons per minute with a 7-foot lift. Mr. Connor advises that his outfit has cost nothing to date for maintenance; that it can be operated by unskilled labor; that the engine requires practically no attention while running, and that the average cost of gasoline per hour is less than 3 cents. In a twenty-four-day service test on the North road from Middleboro the pump lifted water 9 feet at an average rate of 10,800 gallons daily. This test was for the purpose of supplying water during extreme conditions for use in the city, the water pumped by the outfit being delivered to carts and hauled away as desired. The pump worked almost constantly during the twenty-four days, and during the entire time, as Mr. Connor puts it, did not skip a stroke.

The outfit above referred to consists of a sanitary diaphragm pump, driven by a gasoline engine having a cylinder of 4 inches diameter and 4-inch stroke. The engine operates at 400 to 600 revolutions per minute. The cylinder wall is of uniform thickness, with removable sheet iron water jacket, making the engine frost-proof, even when water is allowed to freeze solid in the jacket. The ratio of the pump to the engine speed is 10 to 1 and the normal speed of the pump is about 50 strokes per minute.

Trade Notes

E. J. Cady, consulting accountant, 1812 Harris Trust Building, Chicago, Ill., has become president of The Investigators' Corporation of America, and calls special attention to the efficiency, appraisal and advisory engineering departments of the organization.

The Galion Iron Works and Manufacturing Company is the name of the reorganized Galion Iron Works Company of Galion, Ohio. The capital stock of the new company will be $1,000,000, which is a large increase, to take care of their business, which was increasing too rapidly for the size of the old company.

The Wilson-McKeand Company, specialists in chamber of commerce development, commercial club organization, civic improvement omvements and commission government campaigns, have opened permanent headquarters offices at 1813 Dime Bank Building, Detroit, Mich. The organizers of this company are Mr. Lucius E. Wilson, former secretary of the Detroit Board of Commerce, and Mr. A. W. McKeand, former secretary of the Charleston, S. C., Chamber of Commerce. Associated with these men are several experts in commercial organization work.

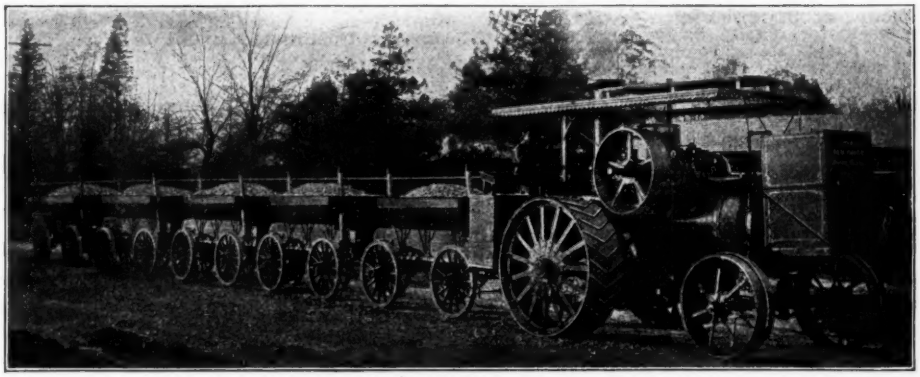
The Geo. A. Schardt Company, Empire Building, Pittsburgh, Pa., have been appointed sales representatives in the surrounding territory for the Steel City Electric Company of Pittsburgh, manufacturers of electrical specialties.

The Wemlinger Company, Inc., 11 Broadway, New York City, who are associated with the Wemlinger Steel Piling Company at the same address, have just been appointed New York and New Jersey sales agents for the Waterloo Cement Machinery Corporation, Waterloo, Iowa, who are the manufacturers of the well-known line of Polygon and Little Wonder oncrete mixers. The Wemlinger Company state that they will carry a full stock of Polygon and Little Wonder machines of various sizes in their New York warehouse, as well as a complete line of repair parts, thereby assuring prompt service to their Eastern customers.

Adaptability and Economy + Speed and Power = The Predominant Advantages of

Huber STEAM AND GAS Tractors

"Easy Work for a Huber"



Because

A Huber can haul in FASTER time, TWICE as many HEAVIER loaded carts per unit of power than horses at less cost than expense of feed for horses to do the same work.

Because

A Huber will save the expense of at least ten men per outfit compared with horses and wagons.

Because the Huber is built *right* on *practical knowledge.*

"Grading for a $1,000,000 City" is the title of a folder SENT FREE ON REQUEST.

The Huber Manufacturing Co.

601 Center Street. MARION, OHIO.

Representatives for Eastern Canada, F. H. HOPKINS & CO., Montreal.

CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Belle Plaine, Iowa.—Jan. 5, until 3 p. m., for 55,718 square yards of paving and 13,570 feet of cement curb and all appurtenances. Work is in six divisions. Certified check for $500, required with each division. Plans and specifications may be obtained from engineer by depositing $5.00 W. M. Ewen, city clerk. Iowa Engineer Co., Clinton, Ia.

Cincinnati, O.—Jan. 16, until noon, for the following county work: Specification No. 571: For repair of Cleves and Dugan Gap road, between Cleves and Ezra Guard's place, in Miami township. Certified check $500. Under specification No. 568: For the improvement of Snyder road through Kleeman's land in Green township. Certified check $500. Fred E. Wesselmann, president board of county commissioners.

Clearwater, Fla.—Jan. 6, until noon, for furnishing all material and labor and constructing about 12,300 square yards of brick pavement on sand foundation and about 19,000 lineal feet of combined concrete curb and gutter, near St. Petersburg, Fla. Also bids for the same pavement of concrete and of bitulithic. Plans and specifications may be seen at the office of the engineer, 314 Home Security Bldg., St. Petersburg, Fla., on and after Dec. 20, 1913. O. T. Railsback, commissioner district No. 1.

Cleveland Heights, O.—Jan. 6, until noon, for furnishing the material and labor necessary for the improvement of Euclid Heights boulevard, from Superior road to Lee road, by grading; certified check 10 per cent. of amount of bid. H. H. Canfield, clerk of village.

Dayton, O.—Jan. 15, until 10 a. m., for the following county work: All materials and labor necessary to build and complete the embankment for the east approach of the Little York bridge, including the gravelling of the roadway of said approach. Approximate quantities: 4,500 cubic yards of embankment 20 feet wide on top with side slopes 1½ horizontal to 1 vertical, and 125 cubic yards of gravel 16 feet wide, 12 inches in center and 6 inches on the sides. Certified check, $100. Walter H. Aszling, secretary board of county commissioners.

Hartford City, Ind.—Jan. 5, until 2 p. m., for furnishing all material and labor for constructing the Stotler No. 2 macadam road situated in Jackson township and for constructing the Whetsel macadam road also in Jackson township. Bond for double the amount of bid must accompany each bid. Jas. Cronin, Jr., auditor.

Kosciusko, Miss.—Jan. 5, until 11 a. m., for the permanent improvement of approximately 17 miles of roads in said district. Novaculite, chert, gravel or crushed stone will be used for finishing surface, and is to be compacted with roller. Probably concrete will be used in the construction of smaller bridges and large culverts. Bids are asked on all kinds of culvert pipe and will be determined by the highway commissioners when prices are received. Bids are invited for doing the entire work or any division thereof separately, consisting of grading, bridging, surfacing and furnishing all materials necessary to complete the above mentioned roads. Plans, profiles and specifications are on file at the office of the chancery clerk of Attala county, Kosciusko, Miss., at the office of Xavier A. Kramer, engineer, Magnolia, Miss., and at the office of the highway commissioner, Kosciusko, Miss. Certified check, $1,000. W. B. Potts, president; G. Lowenburg, secretary, highway commissioners, district No. 1, Attala county, Miss.

Sioux Falls, S. D.—Jan. 26, until 9 a. m., for the construction of pavements on Prairie avenue, from north line of Third street to south line of Twelfth street. Bids will be received on each of the following kinds of pavements: Bitulithic, Tarvia macadam, asphaltic concrete and Dolarway. Certified check, $1,500, made payable to city treasurer must accompany each bid. The work will consist of approximately the following quantities: 15,000 square yards of pavements outside of street car tracks; 3,000 square yards of pavement along the street car tracks. Specifications in blank form of proposal may be obtained from S. B. Howe, city engineer. Walter C. Leyse, city auditor.

CONTRACTS AWARDED.

Baton Rouge, La.—G. W. Prutsman, Danville, Ill., at bid of $35,979 was awarded contract for recrowning and graveling the highway from Baton Rouge to Hope Villa, a distance of about 14 miles. Other bids were G. W. Garig, Baton Rouge, $38,528; Worthington Construction Co., Brookhaven, Miss., $40,637; Boyd & Bradshaw, Columbia, Miss., $43,360; Lenham Bros., Baton Rouge, $44,058.

Belton, Tex.—The Texas Granitoid Co., of San Antonio, was awarded contract for about 1,700 square yards of paving and 700 linear yards of curbing at bid of $2.24 per square yard.

Dresden, O.—Contract was awarded to George H. Heffner & Son, Celina, O., at about $30,000, for paving of Main street, from canal bank to corporation line, consisting of concrete base.

Elgin, Ill.—Logan & Giertz, local firm was awarded contract for paving with asphaltic-macadam the first district in West Chicago. Contract price, $71,905.

Frankfort, Ind.—The contract for improving a county line highway between Marion and Hendricks county, north from Clermont was awarded to McKinsey & Jenkins, of Frankfort. The successful bid was $7,895. The work must be completed before Oct. 1, 1914.

Gallipolis, O.—Contract was awarded to Jas. L. Betz, of Gallipolis, and Thomas Jones, of Patriot, for paving of 2d avenue, from Court street to Vine street, and Vine to 3d avenue, with vitrified brick, at $1.26 per square yard.

Grand Rapids, Mich.—Contract for 3 miles of the Blackberry-Warba road was awarded to I. M. Dowling, of Duluth, at $5,000.

Lafayette, La.—Contract was awarded to Worthington Construction Co., Brookhaven, Miss., at $47,800 for 16 miles of gravel roads, diverging from Lafayette, by good roads commission.

Lawrenceburg, Ind.—T. F. Wilson & Son, of Brookville, Ind., was awarded contract for construction of the Miller township road, at bid of $13,876.

Medford, Oregon.—Kessel & McDowell Logging Co., of Tacoma, Wash., was awarded contract for grading the Pacific highway over Siskiyou mountains, at $107,534.

Newark, N. J.—Contract for the paving of Broad street, with wood blocks, has been awarded by the board of works to Newark Paving Co., 133 1st street, at $273,473.

Pennsgrove, N. J.—John P. Holmes, Pennsgrove, N. J., has been awarded a contract by the county commissioners for reconstructing several miles of highway near Pennsgrove.

Richmond, Ind.—The county commission-

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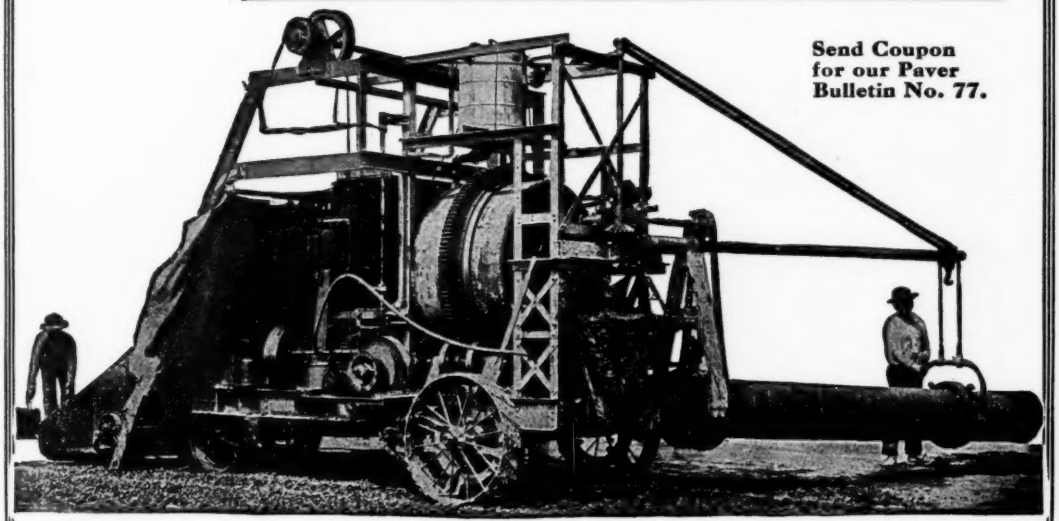

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ers let the contract for the Commons bridge fill, west of the city, to T. J. Connell, of Milton, at 34½c a cubic yard.

San Mateo, Cal.—A contract for the paving of the lower half of San Mateo Park was awarded to Clark & Henry, Stall Bldg., Sacramento, by the board of trustees for $107,000.

South Bend, Ind.—Jerry Donovan, a South Bend contractor, was the successful bidder for the Center township road, St. Joseph county, his contract price being $25,900.00.

Tipton, Ind.—Brown, Hinds & Hinds, of this city, were awarded contract for gravel road construction in Cicero township, at bid of $3,750.

Williamsport, Pa.—Contract for constructing an 8-mile macadam road near Williamsport, has been awarded to Kelly & Brown, of Williamsport.

CONTEMPLATED WORK.

Faribault, Minn.—City contemplates 21 blocks pavements in the spring; creosote block. Frank McKellip, city engineer.

Red Wing, Minn.—Surveys for a road from Red Wing to Zumbrota, 22 miles, are being made by Wm. J. Geisheker, engineer, city, for the State Highway Commission, St. Paul.

Terre Haute, Ind.—County Surveyor Herbert C. Anderson has prepared new plans and specifications for the improvement with vitrified brick of E. Wabash avenue, from 25th street east to the Harrison township line; estimated cost, $58,000.

SEWERS.

BIDS REQUESTED.

Butte, Mont.—(Readvertisement), March 1, until 5 p. m., for a sanitary sewer in Mercury and Diamond streets. Certified check, $1,000. W. A. Willis, city clerk.

Clinton, Iowa—January 13, until 8 p. m., for the construction of a sewer in Eighth street from Tenth avenue to alley south of Eleventh avenue, on Eleventh avenue from point 280½ feet east of Eighth street to Ninth street, and on Ninth street from Eleventh avenue to alley south of Eleventh avenue. Plans and specifications may be seen at office of city clerk. E. M. Howes, mayor. Frank W. Leddham, city clerk.

Montevideo, Minn.—January 5, until 8 p. m., for furnishing the material and constructing 2,142 feet of sanitary sewer. Certified check, 10 per cent. of bid, must accompany each bid. A. M. Parks, city clerk.

New Albany, Miss.—January 6, until 8 p. m., for the construction of a general sewerage system. S. W. Beville, city clerk.

CONTRACTS AWARDED.

Baltimore, Md.—Specifications are being prepared by C. W. Hendrick, chief engineer of sewerage commission, covering four sanitary contracts involving about 88,000 linear feet of intercepters, lateral sewers and house connections, amounting to over $300,000. Contracts will be started the first part of spring.

Clarion, Iowa—Plans contemplated for about 5½ miles sewer work; definite announcement expected about February 1. Address city clerk. Engineer Carrie, Webster City, has plans nearly perfected; cost about $40,000.

Cuyuna, Minn.—James G. Lawson, of Duluth, has been engaged to draw plans and superintend the installation of sewers here.

Douglas, Ariz.—Council has instructed the city engineer to prepare plans, etc., at once for a sewer system in the Clawson addition. J. P. Sexton, city engineer.

Reedley, Cal.—Plans are being made by Engineer Chris J. Jensen, Fresno, Cal., for a sewer system here to cost about $40,000, and to include disposal works and pipe system. Contract will be let about February.

Salem, Ill.—Plans and estimates are being prepared by Consulting Engineer John S. Spiker, of Vincennes, Ind., for the proposed sanitary sewer system and purification plant, estimated to cost $88,000. Bids are to be asked in the spring.

SEWAGE DISPOSAL PLANTS.

Canton, O.—The following bids were received for the construction of the sewage disposal plant: Grant, Sarstedt & Meriman, Cleveland, stone or slag filters, $243,205; gravel filters, $212,810. J. C. Devine, Alliance, slag, $237,382; screened cinders, $251,719; gravel, $260,322. Fletcher & Ule, Akron, slag, $244,876; gravel, $266,096. Larrowe Construction Company, Detroit, slag, $275,187; cinders, $293,826; gravel, $288,091. Pitt Construction Company, Pittsburgh, slag, $261,523; cinders, $298,801; gravel, $298,801. Masters & Mullen, Cleveland, slag, $292,145; cinders, $286,410, and gravel, $272,073.

Tampa, Fla.—The following bids were submitted for the construction of the Imhoff sanitary sewer system (divided into ten sections): G. Jeager, of Rich Hill, Mo., bid on Sections 5, 6 and 7, accompanying his bid with certified checks for $7,500 and $5,000. M. P. Flynn, Chattanooga, bid on Section 9, accompanying bid with two checks of $600 each. Bryan & Co., Jacksonville, bid on Sections 5 and 7, furnishing checks for $2,500, $2,500, $1,000, $1,000 and $3,000. H. H. Snyder & Co., Louisville, submitting checks for $5,000 and $2,500, bid $174,923 for constructing Section 1 and $55,042 for Section 2. A. J. Martin & Co., Augusta, filing a check for $2,500, bid $17,109 for constructing Section 1 or approximately $93,000 less than the first bid submitted for this section. McGucken & Hyer, of this city, filing check for $4,370, bid $129,208 for construction of Section 1 and $43,075 for Section 2. The bid for Section 2 was lowest submitted, and the probability is that this firm will be awarded this part of the contract. The Edwards Construction Company, of this city, filing check for $1,663, bid $28,710 for Section 3, $33,805 for Section 4 and actual cost of labor and material plus 10 per cent. for Sections 1 and 2. J. C. Neil, Tampa, bid on Section 6, submitting a check for $600. Guild & Co., Chattanooga, filing checks for $2,500, $1,500 and $2,500, entered bids for Sections 6 and 7. Bidders, in conformity with instructions, offered certified checks for 2½ per cent. of the total amount of their bid on each section.

WATER WORKS.

BIDS REQUESTED.

Boston, Mass.—(Readvertisement), until January 15, bids will be received for furnishing and erecting electric pumping plant for high pressure fire service in underground pumping station, Charles street. L. K. Rourke, commissioner of public works.

Columbus, Mont.—January 12, until 8 p. m., for construction of a water system; estimated cost, $25,000. George A. Westover, town clerk.

New Bremen, O.—January 10, until noon, for one motor-driven water pump, working head 46 pounds and a maximum pressure of 100 pounds. E. R. Haines, village clerk.

Newport Beach, Cal.—About January 15, for about four miles of water mains at a cost of about $25,000. L. S. Wilkinson, city clerk.

Potosi, Mo.—January 12, until 7:30 p. m., for drilling a deep well 1,000 feet or less. Information, etc., regarding same can be had from H. C. Bell, city clerk, or Monie & Dun-

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Taylorville, Ky.—Until February 7, bids will be received for constructing water works with reservoir pumps and engines complete. J. H. Reid, chairman water commission.

Winchester, Ill.—January 6, until 7:30 p. m., for furnishing material and labor and constructing a municipal water works system. The material and equipment to be installed is approximately as follows: 9,636 feet 8-inch cast iron class E pipe; 3,420 feet 6-inch cast iron class E pipe; 22,116 feet 4-inch cast iron class E pipe; 14,000 pounds special castings; 2,280 feet 2-inch galvanized iron pipe; 6 8-inch gate valves with boxes; 3 6-inch gate valves with boxes; 23 4-inch gate valves with boxes; 3 2-inch gate valves with boxes; 39 fire hydrants; 180,000 gallon steel tank on a 110-ft. 4-post steel tower; 2 motor-driven deep well tube pumps, capacity 50 gallons each per minute against a head of 235 feet; 2 brick buildings 10x12 feet; all concrete foundations for tower and tank, buildings and pumping equipment; 2 8-inch wells, 42 feet deep; all pump house piping. Certified check, 5 per cent. of amount of bid. Dr. H. H. Fletcher, mayor.

CONTRACTS AWARDED.

Cherryville, N. C.—B. F. Roberts, of Macon, Ga., was awarded the contract for water works system here.

Centralia, Wash.—W. H. Mitchell, of Seattle, at $124,759, was awarded the construction of the municipal gravity water system. Work will begin about January 1. Stanley Macomber, city engineer.

Frankfort, O.—Contract for constructing water works is reported awarded to Harper-Rossitor Company, of Bremen, at $13,775.

Minatare, Neb.—The contract is reported awarded to J. S. Schwartz, of Colorado Springs, Col., for construction of water works at $13,472.

Hopkins, Mo.—The Hopkins city council awarded the contract for the building of their water works plant to the Vash & Gray Company, of Joplin, Mo., for $10,151.

Manassas, Va.—Applegate & Son, Bradford, Pa., at $31,438, were awarded the contract for furnishing of labor and material for the installation of a water works system.

BRIDGES.

BIDS REQUESTED.

Cleveland, O.—January 21, until 11 a. m., for the construction of bridge work per report No. 3242, in accordance with the form of contract and specifications to be furnished by W. A. Stinchcomb, county surveyor. Certified check for 10 per cent. of amount of engineer's estimate required with each bid. John F. Goldenbogen, clerk of Cuyahoga county.

Geneva, Neb.—January 13, until noon, for bent and pile steel and wooden bridges required during the twelve months, beginning January 13, 1914. Bert A. Lynn, Fillmore county clerk.

Houston, Tex.—About February 1, for the construction of a reinforced concrete bridge over Buffalo river at Franklin avenue and Louisiana street. The bidder is invited to submit a bid based on either his own design, which must be in accordance with the specifications now on file in the office of the city engineer, or from the plans and specifications prepared by the city engineer. Contractors who are prepared to design the bridge as well as bid on the construction are invited to inspect the site and call at the office of the city engineer for specifications covering the requirements of such design. Contractors who are prepared to bid upon the plans as prepared by the city engineer's office about January 15, at which time the plans and specifications will be completed. The preliminary estimate of the cost of this bridge is $140,000. E. E. Sands, city engineer; Ben Campbell, mayor.

Manhattan, Kans.—January 6, until noon, for the construction of a bridge approach in Riley county, as follows: Ashland Bridge Approach—This is 150 feet long and 16 feet roadway with a reinforced concrete floor. The supersrtucture is 5 I-beam spans each 30 feet long. The substructure consists of a plain concrete abutment and four bents. There are two designs for the bents, one for steel and one for reinforced concrete. Bids will be received on each of the designs. Concrete piling 21 feet long will be required to support the foundation. A deposit of $50 must accompany each bid. Address County Clerk.

Saginaw, Mich.—January 8, until 2 p. m., for construction of a 202-ft. highway bridge over Cass river on East street road. J. W. Ederer, county road commissioner.

Zanesville, O.—January 14, until 11 a. m., for furnishing the material and labor for construction, building and placing of certain new bridge across Crow run, near Stones station, on Malta road, in Harrison township. Bridge to consist of one span 81 feet, 8 inches long from center to center of end bearings, and to have a roadway of 14 feet in the clear. Floor to be creosoted plank and blocks, or a plain 3-inch plank floor. Bridge to have a carrying capacity on floor sufficient to support a 15-ton road roller. All connections shall be riveted. The structure shall be thoroly anchored to abutments at both ends but free to slide at one end in slotted holes. Certified check, 10 per cent. of amount of bid required. Fred C. Werner, clerk of Muskingum county commissioners.

CONTRACTS AWARDED.

Bay Minette, Ala.—Contract for construction of bridge 150 feet long of reinforced concrete was awarded Latimer & Burkett, of Memphis, Tenn., at $3,775.

Caldwell, Idaho—J. H. Forbes & Co., were awarded contract for construction of three bridges in Canyon county at $47,620.

Cincinnati, O.—The contract for the Hopple street viaduct has been awarded to the Kirshner Construction Company, Cincinnati, Ohio, at $413,765.

Macedon, N. Y.—Contracts were awarded to L. M. Ludington's Sons, Inc., Rochester, N. Y., at $94,393 for substructure and superstructure of bridge at Edgett street, Newark, and superstructure of bridge at Peek's, both within contract No. 76, and for substructure and superstructure of bridge at Macedon.

Pittsburgh, Pa.—Booth & Flinn will be awarded contract for construction of the north and south approaches to the Northside Point bridge. Bid, $264,000.

Tampa, Fla.—Contract for construction of concrete bridge on West Michigan avenue was awarded to A. N. Snow for $1,192. R. L. Davis' bid was $1,729; H. W. Cooley & Co., $1,511; Lester & Co., $1,640.50; J. L. Roumillet, $1,412.60, and McGucken & Hyer, $1,250.

CONTEMPLATED WORK.

Houston, Tex.—Plans will soon be prepared for the Preston avenue bridge. It is to be of reinforced concrete and will cost about $150,000. For further information address E. E. Sands, city engineer. Ben, Campbell, mayor.

Grand Rapids, Mich.—Lehigh E. Stevens, city engineer, has estimated the cost of the proposed new concrete bridge at Pearl street to be $138,000.

AUTOMOBILES—FIRE APPARATUS.

Darby, Pa.—Fire Patrol No. 2 plans to purchase a motor combination chemical and hose car.

Yonkers, N. Y.—January 5 bids will be re-

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ceived for two combination chemical and hose motor apparatus. Mr. Lennon, mayor.

Washington, D. C.—No. 1301—Automobile Accessories and Novelties—An American consul has forwarded the names of four firms in his district that are anxious to receive catalogs and price lists of automobile accessories and novelties. Correspondence and catalogs must be in Spanish or French. No. 12187—Gasoline motors, plows and traction wagons. A report from an American consular officer states that an European engineering firm wishes to secure the agency for the sale of American gasoline motors, gasoline motor plows and traction wagons. The firm is prepared to submit satisfactory references. Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying for addresses refer to file number.

GARBAGE DISPOSAL PLANTS.

Pensacola, Fla.—Following bids were received on the erection of a second crematory plant: Decarie Incinerator Co., Minneapolis, Minn., $7,000; Atkinson-Morse Destructor Co., New York City, $12,560, and Nye Odorless Co., Macon, Ga., $3,500.

Queens Boro, N. Y. City—The following were low bids received in connection with the garbage destruction works on Flushing avenue in Ridgewood: General construction of main building, Peter Cleary, $46,091; stable house, Werner-Bartels Co., $62,287; plumbing and gas fitting main building, J. Braumstein & Co., $1,550; of stable and section house, Altman Plumbing Co., $5.400; and for steam heating of stable and section house, Phillip A. Fox & Co., $3,450.

BUILDINGS.

BIDS REQUESTED.

Chadron, Neb.—Until January 13, for a wing to the normal school here, 3-story, brick, 50x60, cost $30,000, fireproof, work to start next spring; steel frame and beams, tile, reinforced concrete and gypsum fireproofing, lime cut stone, common pressed brick, hollow, steam heat, electric lights, composition roof, patent plaster, metal lath, corner bead, lead and oil paint, P. & L. varnish, wired and figured glass, tile floor, marble baseboard, oak finish; plans by J. C. Stitts, architect; Norfolk, Neb. J. J. Tooley, secretary school board.

Doyon, N. D.—January 13, until 1 p. m., for ventilating, plumbing and heating the school building, according to plans and specifications on file with F. S. Chamberlin, clerk of board, or at office of architect, John Marshall, Devils Lake, N. D.; check for $100 payable to John B. LaRue, president of the board, required with each bid.

Heber Springs, Ark.—Until January 22, for the erection of a brick and concrete fireproof court house to cost $50,000. Clyde A. Ferrell, architect, Little Rock, Ark.

Lodi, N. J.—Until January 14, bids will be received for the erection of a 13-classroom school. Bids will be received as a whole or separately for carpenter work, including sheet metal work, plumbing, electric wiring; ventilating and heating; masonry, including reinforced concrete and iron work. Anton L. Vegluante, architect. First National Bank building, Garfield. John J. Goeghegan, mayor.

Valparaiso, Ind.—Until February 9, for the construction of the Valparaiso Public Library building. Each bid must be addressed to the Public Library Board of the City of Valparaiso, Ind. O. P. Kinsey, president, Valparaiso, Ind., care of State Bank, and marked "Bid for the construction of the Valparaiso Public Library building," and delivered in person or by registered mail to the State Bank of Valparaiso on or before February 9, 1914. Certified check for $800 must accompany each bid. O. P. Kinsey, president.

CONTRACTS AWARDED.

Centralia, Ill.—Contract has been awarded by the board of education to D. S. Peatre & Co., of Centralia, for erecting a high school at $35,000.

Chisholm, Minn.—Johnson & Wayne, of Hibbing, were awarded contract for construction of a municipal detention hospital at bid of $8,122.

Jersey City, N. J.—W. H. & F. W. Cane, Woolworth building, New York City, at $308,488, were awarded construction of Public School No. 24.

Kansas City, Mo.—Contract for erecting a shelter and comfort building at Seventeenth and West, Prospect Place, West Terrace park, was awarded to Alex. Kinghorn, Kansas City, at bid of $17,500, and the heating to Freil & Foley, at bid of $2,700.

Moline, Ill.—C. W. Cline, local contractor, was awarded contract for erecting new bath house at Prospect park. Contract price, $2,360.

Wheatland, Wyo.—Contract for plans and specifications for a $40,000 court house was awarded to Berreson Bros., architects, of Denver, Col.

CONTEMPLATED WORK.

Edwardsville, Ill.—R. G. Kirsch, architect, St. Louis, Mo., will prepare plans and supervise the construction of the $250,000 court house for Madison county, here. The building will be 125x160 feet and 68 feet high.

Elkhorn, Wis.—Van Ryn & DeGelleke, a Milwaukee firm of architects, have been engaged to prepare plans for the proposed new jail building.

Long Island, L. I., N. Y.—Tentative plans have been prepared for a number of city market buildings and a cold storage building to be erected adjacent to the Newtown creek and Dutch Hills canal, Long Island City. Estimate cost, $4,000,000. Cyrus C. Miller, Tremont and Third avenues, New York City, is chairman of the mayor's committee. Maurice E. Connolly, president of Queens Boro.

Lorain, O.—A bond issue for $10,000 has been authorized to provide for the building of a new fire station on the west side. T. W. Pape, mayor.

Pittsburgh, Pa.—Plans are being prepared by Ingham & Boyd, 323 Fourth avenue, for a two-story brick elementary school to be erected on Webster avenue and Watt street, at a cost of $185,000.

Sioux City, Iowa—County commissioners will construct a new 150x150-feet, six-story court house at an estimated cost of $1,000,000. The building, for which rough sketches have been made, will have four acres of floor space. Henry Metz, supervisor.

Waterloo, N. Y.—Plans have been completed for the erection of a new jail. Estimated cost, $32,000. George F. Bodine, counsel for Seneca county board of supervisors.

Waterloo, Iowa—Contract for construction of the proposed new county hospital will probably be awarded during the winter. Estimated cost, $35,000. W. C. Leland, member county board.

MISCELLANEOUS.

Cleveland, O.—January 7, until noon, bids will be received for economizers, fans, etc., for the municipal electric light plant. W. H. Kirby, secretary to director of public service.

Dalton, Ga.—The Manly Jail Works of this city write they are in the market for interlocking sheet steel piling for doing cofferdam work and would like catalogs and prices on same.